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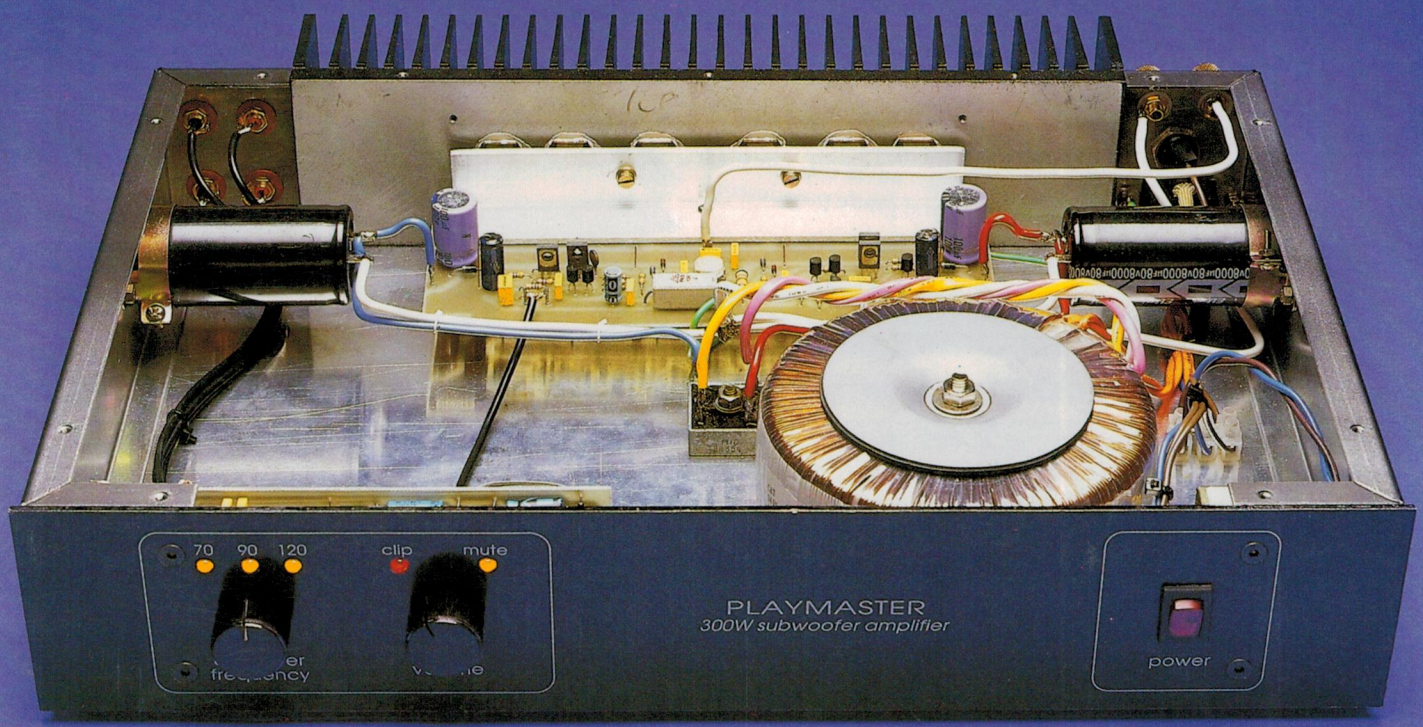

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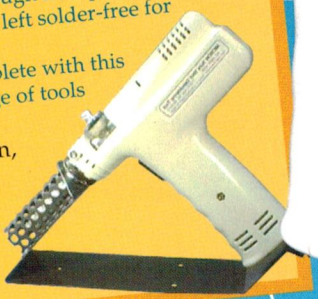

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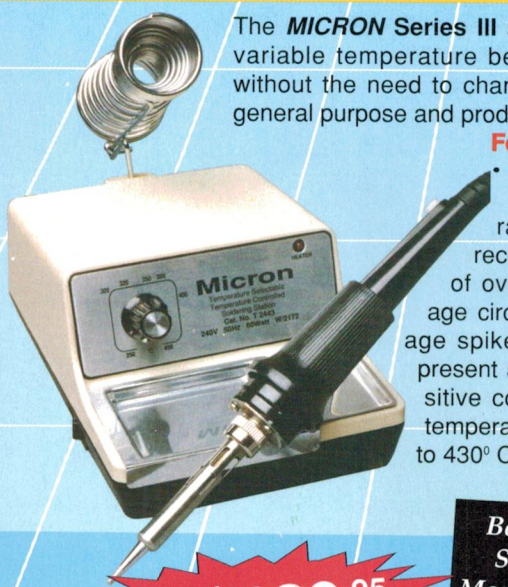

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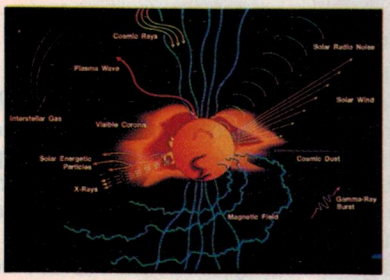
READER INFO NO. 1

Electronics AUSTRALIA WITH ETI

Volume 57, No.4
April 1995

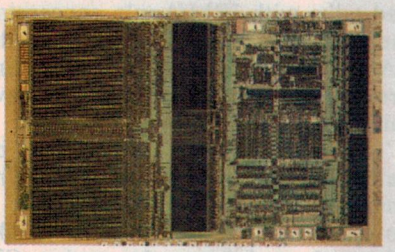
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Spying on the sun...



After a journey of over four years, the European Space Agency's solar research craft Ulysses is now orbiting and surveying the Sun. Our space writer Kate Doolan provides an update on the mission, in her story starting on page 26.

Inside the new 'smart' cards



Around the world, conventional credit, debit and ID cards are being replaced with 'smart' cards, which offer a much higher level of security. Some types can be interrogated by radio, while they're still in your wallet or purse. Robert Owen explains how the new cards work, in his story starting on page 20.

On the cover

Our main photo this month shows the new Playmaster Pro Series 300W Subwoofer Amplifier, designed by EA's Technical Editor Rob Evans (see page 58). The smaller photo shows our Minispot Mk2, a handy signal source for radio alignment (see page 68). Photos: Greg McBean.

Video and Audio

6 **WHAT'S NEW IN VIDEO & AUDIO** *New Philips CTV with 'Incredible Sound'*
8 **'INTERACTIVE' TAKES CENTRE STAGE AT CES** *Report from Las Vegas*
14 **THE CHALLIS REPORT** *VAF's DC-7 Mk2 Loudspeaker System*

Features

20 **WHAT'S INSIDE THE NEW 'SMART' CARDS** *Robert Owen explains...*
23 **TEACHING ELECTRONICS AT HOME** *Don't let your knowledge go to waste!*
26 **SPYING ON THE SUN** *An update on the ESO's Ulysses space mission*
32 **MOFFAT'S MADHOUSE** *E-mail, J-mail and gobbledygook*
36 **WHEN I THINK BACK...** *Readers have their say — 2: what are 'collectables'?*

Projects and Technical

44 **THE SERVICEMAN** *The polarity of VW car batteries, and servicing tip risks*
48 **DSE 'DISCOVERY SERIES' KIT:** *38-LED 'Roulette Wheel'*
56 **CIRCUIT & DESIGN IDEAS** *Karaoke converter, in-circuit transistor tester*
58 **PLAYMASTER 300W SUBWOOFER AMP - 1** *Circuit details and specs*
68 **MINISPOT 2 AM/FM ALIGNMENT SOURCE** *Handy, low cost unit*
72 **EXPERIMENTING WITH ELECTRONICS** *'COB' sound generators*
80 **DIGITAL TRIGGER ADAPTOR FOR SCOPES** *For low cost logic analysis*
93 **AUTOMOTIVE ELECTRONICS** *Using a 'scope for vehicle faultfinding...*
100 **VINTAGE RADIO** *A miniature Eddystone receiver — the 870A*

Professional Electronics

106 **NEWS HIGHLIGHTS** *Agreement reached on 'Super Density' video CDs*
110 **THE SUPERFUSER** *Transfers toner images direct to PCBs or front panels...*
112 **SOLID STATE UPDATE** *200MHz video driver IC; low dropout regulator*
114 **SOFTWARE BASED LOGIC ANALYSER** *Uses a PC's standard printer port*
116 **NEW PRODUCTS** *H-P's new 34420A low cost nanovolt/micro-ohm meter*
118 **FEATURE ON COMPONENTS** *Solid state relays, ISDN isolation transformers*
122 **SPOTLIGHT ON SOFTWARE:** *Jobsheet 2000 — for the service workshop*
124 **SILICON VALLEY NEWSLETTER** *Kobe quake will hit Valley's chip supplies*
126 **COMPUTER NEWS & NEW PRODUCTS** *Ruggedised laptop, analog input card*

Columns and Comments

4 **LETTERS TO THE EDITOR**
5 **EDITORIAL VIEWPOINT** *Thanks for your support of our computer BBS!*
35 **SHORTWAVE LISTENING** *Vanuatu installs all new equipment*
40 **FORUM** *Australia's mains voltage, and why can't you use a CD player on a plane?*
86 **INFORMATION CENTRE** *EA's new computer BBS explained...*

Departments

24 **BOOK REVIEWS**
96 **MARKETPLACE**
104 **EA HISTORY, CROSSWORD**
130 **DIRECTORY OF SUPPLIERS**
130 **ADVERTISING INDEX**
62,89 **NOTES AND ERRATA**

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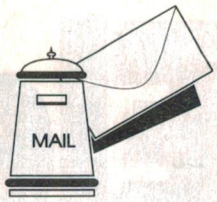
LETTERS TO THE EDITOR



Etone subwoofer

A Mr P. Gonda inquired in your February letters column as to the whereabouts of an Etone SW250 subwoofer.

This product was made exclusively for Jaycar, by Etone. It was sold by us for about eight years but has been discontinued for some time now.

It is quite possible that one of your readers has one to sell to Mr Gonda, but frankly, Mr Gonda would do a lot better to look at more modern subwoofers. The SW250 was designed around a musical instrument loudspeaker, and this approach is no longer considered appropriate.

May I suggest that Mr Gonda refers to *EA* January 1993 for your 12" subwoofer design. The SW250 is simply no match for the performance of this system.

Gary Johnston,
MD - Jaycar Electronics,
Rhodes, NSW.

And from Etone...

I have written direct to Mr P. Gonda of Linden Park in South Australia, to notify him that we are still alive and well in answer to his letter published February 1995.

We have enclosed some information for your interest and advised Mr Gonda that we can still supply *limited* quantities of the SW250, or repair all Etone and many other brands.

If we can be of any further assistance do not hesitate to contact us.

John Donovan,
Etone Pty Ltd,
6 - 12 Stanley Street,
Peakhurst, NSW. 2210.
Phone: (02) 534 3569.

DMM schematic

Would any of your readers have the schematic for the Micronta Digital Multimeter Model 22-198AA and if so could they please fax it to me (reversing charges) or post at my expense. The distributors of this ten year old instrument (Tandy) are unable to supply.

I accidentally blew the resistance function and on inspection under the hood found two power diodes with sooty feet which tested OK. After refitting the function came good; I would not have had the faintest idea if not for years of reading your magazine.

J. Beasley,
10 Dunbar Street,
Margate, Qld. 4019.
Phone/fax: (07) 883 1426

Commodore rescue

In the February 1995 issue of *EA*, a Mr Joshua Pryor of Belmont NSW, wrote into the Letters to the Editor section. Obviously someone who appreciates the Amiga range of computers, he was just a bit wrong with some of his 'buy-out' facts.

As of January 1995, no one has actually bought Commodore out. There are three bids currently under offer, from the Commodore UK Management, CEI (Creative Equipment International — a US company), and Escomm (German manufacturer and distributor of PC compatibles and clones).

Both the Commodore UK and CEI plans for the next generation of Amiga are very similar. For the CPU CEI have had talks with IBM/Apple concerning the PowerPC, and HP concerning the PARISC; either way it looks very promising. All Commodore UK have said is RISC.

The AAA custom chipset will be canned by Commodore UK. The chips are virtually finished but there is no operating system, which would take 18 months to bring to the market. CEI seem more than happy to use the AAA chipset, referred to internally as a 3D/RISC chipset.

CEI hope to have the new generation of Amigas as multi operating system machines, with AmigaDos first and everything else just an added extra.

Mr Pryor also mentioned the Amiga's current operating system, perfectly described! And this operating system used to run on a 7MHz 68000, with 256KB of RAM, a double density 3.5" (880KB) floppy, and no hard disk! And is still faster and easier to use than a 486/33 with 4MB of RAM, trying to run Windows 3.1, which isn't pre-emptive (meaning it appears to be running two or more programs simultaneously, so the program in the background will continue to run while you work on another).

1985... 1995, about time Microsoft Windows started to catch up.

Commodore did fail to cut out a niche for itself, but the Amiga sure hasn't. In the USA, Sea Quest DSV has all its special effects performed on Amigas, as does Babylon 5 (which won an Emmy for it's SFX!), Star Trek — Deep Space Nine, and the television series of RoboCop. Instead of using miniature Models (ST-TNG) or an SGS (Silicon Graphics Station-$$$$$), they chose a machine that offers brilliant performance at small cost.

The Amiga will not die off, just Commodore, which deserves it. The future is looking very bright.

Stuart McVicar,
Geraldton, WA.

32V history

Several months ago I wrote to you seeking information via your magazine and readers on information on the history of 32 volts in Australia. I also wrote to the Historical Radio Society of Australia Inc, with a similar plea.

I received letters and phone calls from many individuals assisting me with my research, for which I am most grateful. Some people within the power industry who I believed would have documents, and other data either had nothing or didn't answer my letters, which was disappointing.

From the anecdotal information and the few schematics I have received I should be able to assemble a moderately accurate history of 32 volt lighting/power plants in Australia. However, it will not be as accurate or as complete as I would like it to be. I would still appreciate receiving any further information that readers may have on the subject, that may fill some of the gaping holes in my information.

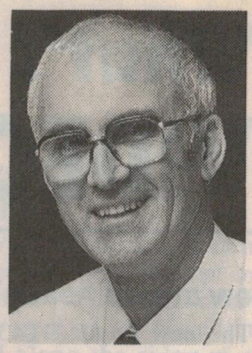
I wish to thank the following readers for their help: R.Jillett, M.O'Malley, A. Manning, D.Kasch, J.Oliver, E.Gibson, A.Thiel, J.Harris, T.Starritt, F.Hawkins, K.& P.McGilvery, and R.Stubbs.

I hope that I haven't missed anyone.

Rodney Champness,
17 Helms Court,
Benalla, Vic. 3672.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Thanks for your support!

In the February issue, you may recall, we announced that an *Electronics Australia* Computer Bulletin Board System had just been set up, as an additional service to readers. The initial idea of the BBS was to make available software for PC-related projects, index files for our projects, notes and errata, and useful electronics-related public domain and 'shareware' software — all in a rather more direct and rapid way than relying on floppy disks sent via the mails.

Although we had received quite a few requests for such a BBS, we were still a little diffident about setting one up. We knew that a high proportion of *EA*'s readers had PCs, but we weren't sure exactly how many of the same readers also had a modem and suitable communications package.

It's now clear that we needn't have worried. As I write this, a little over three weeks since the February issue was published, the response has been overwhelming. The BBS software tells me that it has received over 2000 calls, and more than 220 readers are 'registered' as regular users. Most people have downloaded either index files, software for our projects or PCB design guides (contributed by RCS Radio), and many have left very encouraging messages.

So there's already no doubt that the BBS is meeting a definite need, and should be continued. In this modern era of telecommunications and electronic messaging, it's clearly a facility that will prove of great benefit to our readers, and hopefully to the magazine itself.

I'm sure most of the people who have tried the BBS already will join with me in thanking Peter Harle, Head Teacher of Industrial Electronics and Electrical Engineering at Mount Druitt College of TAFE, for his generous assistance in getting it going. I'd also like to thank our Technical Editor and joint 'sysop' Rob Evans, for all the effort he has put into making the BBS as friendly as possible to use.

Of course it's still early days, and there are quite a few improvements to be made — as some of the people who have left messages on the BBS have suggested. For example we began operation with a 2400b/s modem, and at this modest speed interstate callers have tended to find downloading files a little expensive. But by the time you read this we hope to have replaced the modem with one capable of operating up to at least 9600b/s, alleviating this shortcoming.

Many of the callers have suggested that we provide 'mailbox' areas for dropping contributions to various departments of the magazine (like Letters to the Editor, Information Centre and Forum), electronically. That sounds a good idea, and we'll try to implement it shortly as well. We're also looking at the idea of creating 'discussion group' areas, where readers can exchange information and comments on various electronics topics — a little like the Usenet forums on the Internet.

Some of these refinements might take a little longer than others, though, because it all has to be done in the 'cracks' between our real work in getting the magazine itself out each month!

In the meantime, though, thanks to all of the people who have logged on to the BBS so far, and given it such a warm welcome. And if you haven't tried it yet, the number is (02) 353 0627...

Jim Rowe

'INTERACTIVE' TAKES CENTRE STAGE AT CES

Interactive digital technology took centre stage at the '95 Winter Consumer Electronics Show in Las Vegas, where 91,000 consumer electronics industry representatives tried their hands on the latest products from more than 2000 exhibitors. The show, until recently mostly noted for the launch point of 'what-will-they-think-of-next' televisions, VCRs, car stereo systems, telephones and other consumer electronics gadgets, has transformed during the past two years into the premier showcase for the coming age of interactive digital 'infotainment' — where computing, gaming, information, telecommunications, and entertainment industries merge to create a multi-trillion dollar market that is expected to change profoundly the way people live, work and play.

One of the clearest indicators of the unstoppable nature of this revolution was a survey released by the Electronics Industries Association (EIA), which actually organises the Winter and Summer CES shows. According to the group's latest market data, US consumers spent almost as much on personal computers in 1994 as they did on televisions. In all, some US$8.07 billion was spend by American consumers, on 6.7 million home-bound PCs — only slightly below the US$8.41 billion they spent on 23 million TV sets. As recently as 1991 the US TV market was almost twice the size of the home PC market.

Not surprisingly, large sections of the CES looked more like the Comdex computer show, with huge exhibits from companies such as Microsoft, Intel, Compaq, IBM, Motorola, WordPerfect, Acer, Packard Bell, and many other familiar names in the PC market. Low-cost, but powerful multimedia-capable PCs are the driving force behind the rapid growth of what has already become a vast new consumer market.

Interactive music CDs

One example of where the industry is going is in the combining of music and interactive computing technologies. A few years from now, a single CD will combine a complete audio CD album with lyrics, fan information in the form of magazine articles and video interviews with the artists, videos of live performances and studio recordings, and even some game aspects.

Two companies showed off early examples of these new interactive music CDs. Graphix Zone showed off its recently introduced 'Bob Dylan — Highway 61 Interactive', which allows the player to explore different aspects of Dylan's long career by moving through a digital maze of options which let the player learn about Dylan, listen to any of

by PAUL SWART

Above: Microsoft's Bob design. Left: In the contemporary home, Microsoft Bob personal guide, Chaos the cat, helps the user start a program.

more than 40 full-length audio tracks and 10 full-length video performances, as well as dozens of short video clips of interviews with Dylan and the people around him.

Ardent Record meanwhile released its own first interactive music CD, by a group called 'Two Minutes Hate'. The CD can be played on a regular audio CD, on a Mac or PC CD-ROM drive, and even a Philips or Sony CD-i player. The CD can display the lyrics of each song and give background information on the band members, including video clips.

Bill launches BOB

Key to the proliferation of the digital revolution will be the ease with which millions of people with little or no computer skills will be able to enter the market.

To that end Microsoft made a big splash at CES, with the introduction of the industry's first so-called 'social interface'. BOB, as it is called, is a PC user interface designed for the home environment — in which Microsoft assumes one or more members are techno-phobic and are intimidated with today's business-oriented user interface features such as pull-down windows, folders, files, and various icons.

With BOB, Microsoft has essentially spread the various pull-down menu options across the entire computer display and hid them behind colorful, drawn pictures of familiar things like a telephone (communications) or typewriter (wordprocessing). Other functions included with BOB are Checkbook, Household Manager, Address Book, e-Mail, Calendar and a game program called 'GeoSafari'...

BOB, which was developed with the help of two top Stanford University Social Studies professors, gives each member of the family his or her own privacy-protected 'room' (folder), as well as common areas such as the living room and kitchen where all members can perform tasks and share data.

Microsoft chairman Bill Gates introduced BOB during his keynote address. Gates conceded that today's PCs are still not very easy to use, as shown by several million telephone calls Microsoft receives each year from users who are having problems getting their PC to do what they're supposed to be able to do. "There is just too much to remember, making PCs unapproachable", Gates said.

"The use of the Social Interface is a compelling example of how very sophisticated technology can be applied to make the computing experience better for everyone. This technology will be important in our future efforts."

BOB requires users to know almost nothing about computers, and allows them to use everyday references to operate the machine. When a BOB users turns on his system, for example, the first thing he faces is a typical home front door. Clicking the cursor on the doorbell opens the door into the family room, from which the user can chose various options illustrated by a variety of graphics images. To help the user, BOB features as many as 12 different 'characters', one of which is present at all times to offer guidance and helpful hints.

Industry analysts said they're unsure whether BOB will become the success

The US$99 'virtual guitar' from Aheah allows people who have absolutely no musical talent to play along with music video and audio CDs. The computer shows when to hit the strings, the products the correct guitar sound.

Las Vegas 95 CES

Microsoft is hoping for. To experienced users, BOB only gets in the way of moving from one computer function to another. Some adults may also feel somewhat embarrassed to be seen using BOB, whose graphics and general look-and-feel features appear geared to a small child.

FCC wants a 'level highway'

Besides the latest in PC-based consumer electronics, CES is also the testing ground for most hardware and software products for the future information superhighways. TV manufacturers are aggressively jockeying for position to bring new digital sets to market, built around the US HDTV standard expected to be announced this year by the FCC.

In his opening address, FCC chairman Robert Hundt told a packed house that the FCC is committed to making the information superhighway available to all consumers through fair competition in all markets.

Hundt noted that there are five lanes on the information superhighway: broadcast, cable, satellite, telephone, and wireless. Each of those lanes is currently being 'repaved' in the conversion from analog to digital, he said. "Following the conversion, each lane will be able to handle any combination of voice, video, and data. The FCC's challenge for the digital age is to ensure fair competition for success to all corners and all formats."

The AT&T Two-Line Personal Information Center 882, with speaker-phone, allows users to store up to 200 names and personal information, including phone numbers, addresses and birthdates.

On-line without a PC

Already, millions of PC users are getting some of the benefits of the information superhighway through the Internet and other on-line services. At CES, AT&T drew large crowds to a section of its booth where it was showing a device that enables consumers who have *not* invested in a PC to get many of the same benefits from the on-line data world. AT&T's 'TV Information Center' is a VCR-size box that sits atop your TV set, and connects it to a telephone line.

Using a remote control, viewers will be able to tie into on-line services to display electronic mail, shopping, news, weather, sports, financial, stocks, traffic, banking, and other information on their TV set. The system also functions as a digital telephone and answering machine (with caller-ID). The system will be in US stores this spring and will sell for around US$325.

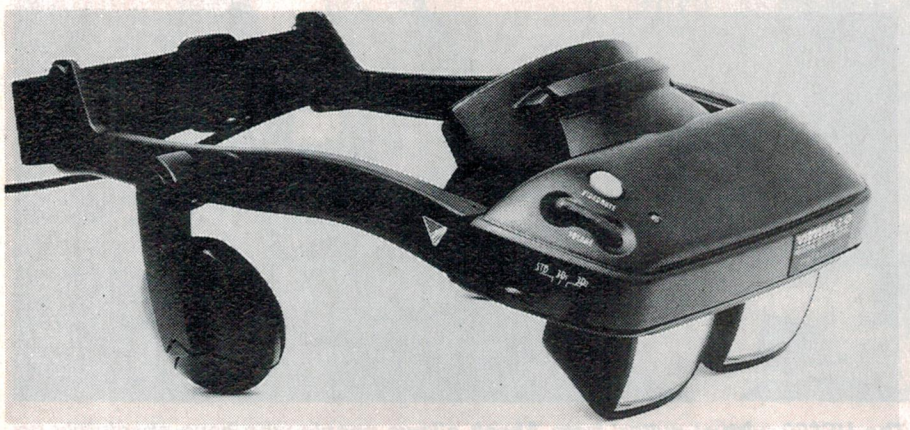
Casio's new video phone can send and receive voice, data and video over standard telephone lines with the pictures being displayed on a TV set or computer display.

Movies on *one* CD

Another popular attraction was the Sony and Philips display of new digital CD players that use new high-density CDs (4.7 gigabytes) and are capable of playing full length movies. Picture and sound quality were outright stunning, when compared to anything available on the VHS videotape format. The new CD movie players will hit the market in early 1996. No prices were made available.

In his keynote address, Sony America president Michael Schulhof noted that only "10 years after the launch of the compact disc, our industry now stands at the threshold of its next technological breakthrough. The new format, Digital Video discs, will permanently alter the home video market and do for Hollywood and filmed entertainment what the CD did for the music industry."

The new 120mm video discs will be able to store enough data for a full-length movie, with the latest in multi-channel digital sound and multi-language subtitling.



Virtual Reality glasses add a whole new dimension to playing games, as illustrated by VR 'Glasses' from Virtual I/O.

Videogame wars

As usual, CES was the battleground between videogame industry leaders Sega and Nintendo. But this year the battlefield appears much enlarged, with 32-bit and 64-bit systems from Atari (Jaguar)

Pioneer's new GPS-X77 vehicle tracking system uses the Global Positioning System to show where you are on a city street map.

and various companies such as Goldstar and Mitsubishi selling 3DO-based multiplayers.

The biggest disappointment of the show was clearly the Virtual Boy, from Nintendo. Billed as the first consumer-level virtual reality game system, Virtual Boy (US$299) has little to offer beyond the simple '3D' hologram-like effects of its laser drawn images. Nintendo chairman Howard Lincoln said he believes the company will sell two million Virtual Boy systems in 1995.

Far more promising than Virtual Boy is Nintendo's forthcoming 64-bit system, currently under development in cooperation with 3D graphics expert Silicon Graphics. A prototype of the 64-bit system demonstrated at CES showed signs of a quantum-leap improvement in the image quality of future video games.

The 64-bit system uses a Silicon Graphics-based 3D imaging engine. And with games being developed in silicon chip modules rather than CD-ROM, the much faster speed of silicon provides for truly stunning graphics qualities, not unlike those seen on high-end 3D workstations. Nintendo said the first 64-bit systems will be on the US market by the end of this year.

Until then however, Sega will have bragging rights to the best image quality, with its 32-bit systems. At a press conference, Sega executives said they are confident they will be able to displace Nintendo as the industry's top video game maker.

Meanwhile, Atari appears to be making progress in returning to the forefront of the video game industry, as the company showed a number of new titles for its 64-bit Jaguar system.

By far the best graphics images, however, are produced by video games developed for the 3DO multiplayers from Mitsubishi, Goldstar and others. A huge 3DO booth displayed dozens of game and other games and instructional programs built around the 3DO technology. Particularly impressive were several sports instructional programs such as golfing and snow boarding, showing users a broad variety of techniques for different levels of skill — using a combination of real-time and slow-motion video clips, voice and data narration.

Industry analysts said it will take at least one or two more years to determine whether the 3DO technology will be able to become 'mainstream'.

Product highlights

Following are a number of other product highlights from the CES show:

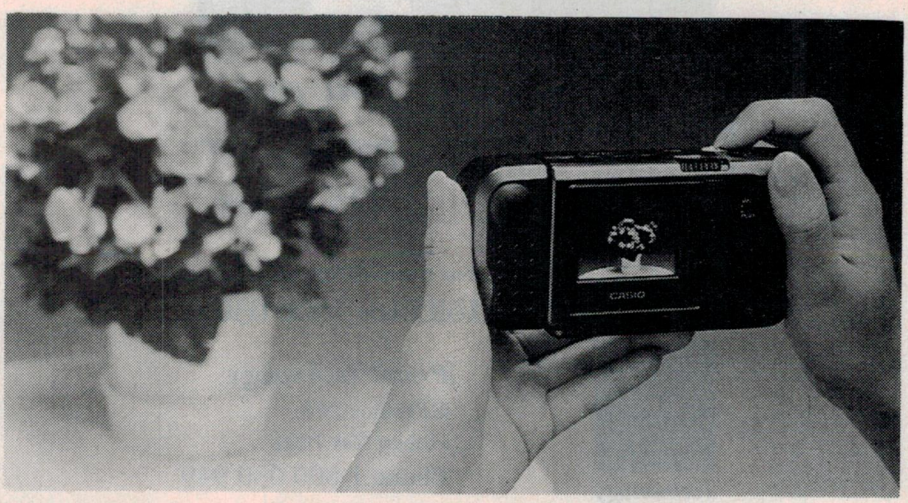
One product that is likely to do very well is the 'No-See-TV' receiver/transmitter from Econologic Technologies, in Palo Alto. The device allows you to listen to television programs when you are away from your TV, such as driving to or from work or on the beach with a portable radio. The battery-powered device will retail for only US$69 this spring.

Users simply key in the number of the local TV station and the device transmits the TV signal from UHF/VHF stations to a special frequency (88.7MHz) receivable on any AM/FM receiver such as a car radio or portable stereo system, or even a Walkman.

A new product that is *unlikely* to succeed is that of 3D television sets. Sanyo displayed a range of 3D sets, ranging from pocket-size systems to 70-inch large screen machines that don't require any special glasses.

To get the best 3D view, you have to be at an optimum distance from the screen. Even then, the 'image-splitting' technique appears to cause an immense strain on the eye, making it almost impossible to watch the screen for more than 10 - 20 seconds.

Pioneer drew large crowds to its booth



Casio's new digital camera allows users to transfer images directly into a PC, TV, VCR or video printer. Images can also be sent to similar cameras via telephone.

Las Vegas 95 CES

Very little virtual reality can be found in Nintendo's Virtual Boy.

for its new GPS-X77 automobile navigation system, which makes uses of the Global Positioning System (GPS) to show the driver his exact location on a street map. The system comes with a five-inch colour LCD display, a GPS receiver and antenna, a wireless remote control, and the central control system with a CD-ROM drive which accepts discs containing detailed street maps of various cities. Among the first cities to be available are the greater Los Angeles area, the San Francisco Bay Area, and the Seattle/Vancouver/Portland metropolitan area. The system will sell for around US$2800 with an additional $150 per map disk.

Casio used CES to launch its new LT-70P Videophone System, which uses ordinary telephone lines to send and receive simultaneous voice and video images. The system uses a new technique called 'CATN' (CAsio Talkvision Network) and uses a TV or PC display and speakers for its video and audio output. Pictures are updated every 3.5 seconds and can be stored into a PC's memory. High-resolution images can be sent every 30 seconds. The system will be distributed through PhoneMate and retail for around US$1300.

Casio also showed off a new digital still camera which allows pictures to be displayed onto a TV or PC screen. Casio's QV-10 LCD digital still camera will retail for US$700. It holds up to 96 color pictures in its memory.

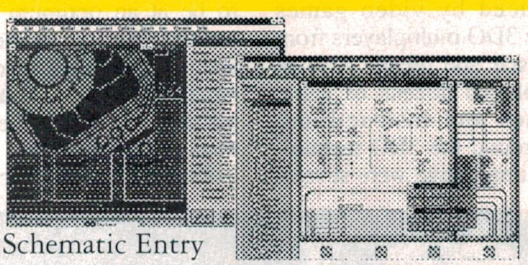
Meanwhile, Sharp launched the 'Viewcamteleport' modem for its Viewcam camcorders, which will allow people to send real-time full-color images taken by a Sharp Viewcam camcorder over the telephone line to another Viewcamteleport — from which it can be displayed on a television or PC display. The Viewcamteleport modem will retail for just under US$900 when it becomes available later this year.

A 3D wireless mouse was introduced by Kantek of Rochester, New York. The 'RingMouse' is attached to the users' right pointing finger and uses infrared light to track finger movements in front of the PC monitor. The two buttons on the mouse are pushed by the thumb.

According to Kantek, the device improves productivity in wordprocessing, spreadsheet, database and other applications and reduces fatigue by eliminating most of the additional hand, wrist, arm and shoulder movements required when using regular mouse-type devices. The RingMouse will cost US$99 and will be available in computer retail stores. ❖

Karaoke is still big, as evident by this new wireless 'Leadsinger' karaoke microphone/system that uses removable song chip modules containing as many as 30 karaoke songs per chip. The microphone transmits the singer's voice plus the chip based music to any FM receiver such as a regular home stereo system.

Protel Design System for Windows



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READER INFO NO. 3

Take a closer look at Pantec

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- Resistance up to 40 MΩ
- Adapter measurements
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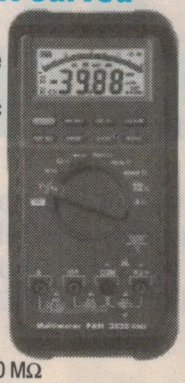

- Auto/manual range selection
- Vdc to 1000 V, Vac to 750 V
- AC/DC current up to 10 A
- True RMS
- Frequency counter up to 1 MHz
- Capacitance measurements
- Adapter measurements
- Resistance up to 40 MΩ
- Diode continuity test
- Water resistant/fire retardant case
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600 A Digital 4000 counts

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- Manual range
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- AC current to 600 A
- AC and DC Volt to 600 V
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- Diode test
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700 A Digital 4000 counts

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READER INFO NO. 4

VAF'S DC-7 MK2 LOUDSPEAKER SYSTEM

Innovative South Australian loudspeaker manufacturer VAF Research has just released a new family of enhanced and upgraded models, in its popular range of competitively priced but high quality kit speaker systems. We asked Louis Challis to run his instruments and critical ears over one of the new systems — the compact DC-7 Mk2, which sells for less than $1000, even when purchased fully assembled.

If you were to ask me which Australian state has the largest number of loud- speaker manufacturers, and also which state has the most successful manufacturers, then the answer would have to be South Australia. So when *EA*'s editor suggested that I really must review a set of speakers from VAF Research in South Australia, my response was "Of course"!

Although I had heard the brand name VAF mentioned once before, I was not aware of the details of VAF Research, nor of its Managing Director Philip Vafiadis. Since 1977, Philip has been carving an interesting and profitable niche in the Australian hi-fi market.

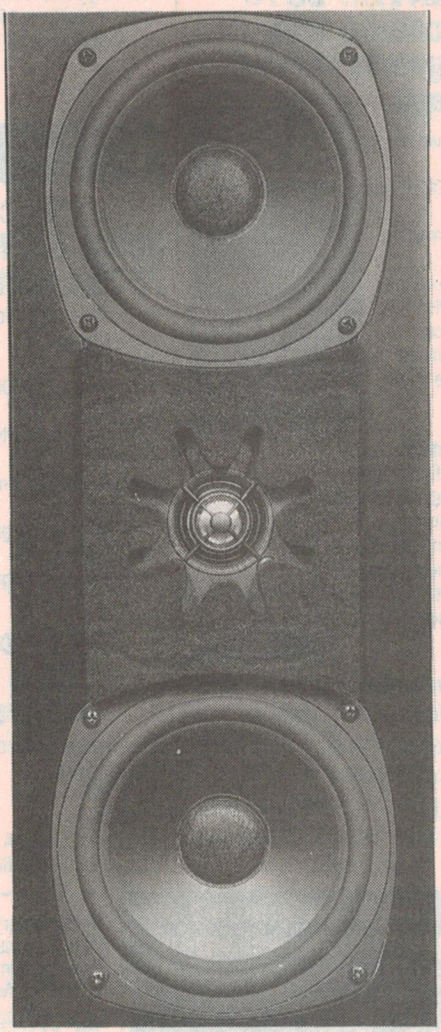
Initially this was through his manufacturing of loudspeaker enclosures for other firms. Subsequently, though, he must have realised that whilst there are (or more likely were) many well heeled hi-fi buffs for whom money is no object, since 1988 those people are a 'dying breed'. So if VAF research was going to achieve an effective market penetration, and in the face of some rather potent competition, then the company would have to develop products that more people would want and be able to buy.

Recently VAF Research has developed an attractive range of six new and improved loudspeaker systems, which are all sold fully assembled for those that want, as well as being offered in a kit form for those that don't! Obviously the cost of assembly and final testing is significant. By leaving it to the intending purchaser to carry out his own soldering, screwing, mounting, gluing and final testing, almost $200 can be cut from the $945 fully assembled price of the DC-7 speaker enclosures.

Obviously that approach works, as about half of the speakers sold by VAF Research are purchased in kit form.

VAF Research also have sufficient confidence in their product to offer a seven day money back guarantee with a three year warranty which includes even the drivers — subject to their not being deliberately overdriven and prematurely destroyed.

When Phillip Vafiadis told me about the extended guarantee on the drivers, I pricked up my ears, as the VAF DC-7 does not incorporate an internal protection circuit. Now even though the VAF drivers may have been very carefully selected with appropriate reserve capacities, as I have often noted, no speaker is idiot proof! I suspect that on occasions there are some delicate negotiations as a result of that guarantee.



A close up of the front of a DC-7 cabinet, showing the felt damping panel around the tweeter.

The DC-7 system

Although the DC-7 speakers are not 'top of the VAF line', they are exceedingly popular — and frankly, there are some good reasons for that popularity. Each tall-but-slim speaker enclosure is well crafted, and neatly finished on all faces in a quality black lacquer. The speakers are protected by a well designed matching black speaker grille. The grille is securely retained by six plastic detents, which ensure minimal warping along the extended frame.

With the grille removed, your attention is initially drawn to the two 130mm diameter VAF bass/mid-range drivers, one above and one below the tweeter. These drivers are a proprietary driver, developed especially for VAF Research. Their main attribute is reasonable linear excursion, and a four-layer winding on the voice coil using an aluminium coil former. The centering and stability is enhanced by the adoption of a secondary support spider. Spiders of this type however, frequently develop sub-resonances of their own, and I suspect that this is one potential liability that VAF Research may not have adequately researched.

Whilst the base/mid-drivers are proprietary, the tweeter is not. This is an SEAS 25mm diameter aluminium rigid coned unit described as VAFM-25, with improvements applied to the basic unit. The most obvious visual improvement is the addition of an 8mm deep felt surround, to control unwanted peripheral radiation and edge reflection. The cut-out has an attractive eight-lobed or petal shaped profile. Whilst the shaping may have been selected with an eye to its visual impact, there can be no denying that the polar sound radiation is extremely smooth, and that a little visual hyperbole doesn't really hurt.

Although the review DC-7 speaker cabinets came fully wired and tested, I asked for, and received the assembly instructions provided with each kit. These confirmed that the

average inexperienced novice should have few troubles in assembling his or her speaker kit. What did catch my eye was that there are two grades of speaker crossover network available. The standard crossover offers 1% tolerance air cored resin bound inductors, with matching (unspecified) close tolerance capacitors and resistors. These are well designed, and incorporate some useful refinements.

One of the options which VAF offers is the alternative 'Ultra' crossovers. These use much heavier gauge wired inductors and are available for those seeking a little extra performance. Not having been given the option of assessing the Ultra crossovers I can't really comment objectively on the merits of spending the extra $85.

I examined the inside of one of the cabinets and confirmed that it contained a foam damping material. I also noted that the crossover had been securely glued into place. The universal terminals are large, effective and neatly recessed in a plastic moulding.

The bass/midrange vented enclosure makes use of a rear venting port, whose ultimate performance will be determined by the rear wall and edge wall spacings. As I subsequently discovered, that rear port and its impact on low frequency performance is inadequately assessed by the conventional anechoic chamber on-axis frequency response testing.

Although VAF Research offer optional spikes as $20 kits, and even provide screwed insert sockets in the base of each enclosure, I suggest that for the average customer the money would be more wisely spent on the better crossover, or better quality (upgraded) internal wiring.

When I picked up the VAF DC-7 enclosure, I was surprised at how easily and comfortably they could be carried out to the anechoic chamber.

The cabinets are well crafted, but I feel one worthwhile option that's missing from the list of optional extras would be an 'Ultra Cabinet'. If such an option were offered, then it ought to offer thicker or more effectively damped side panels. That would really achieve some healthy improvements by way of reduced cabinet resonances.

Objective testing

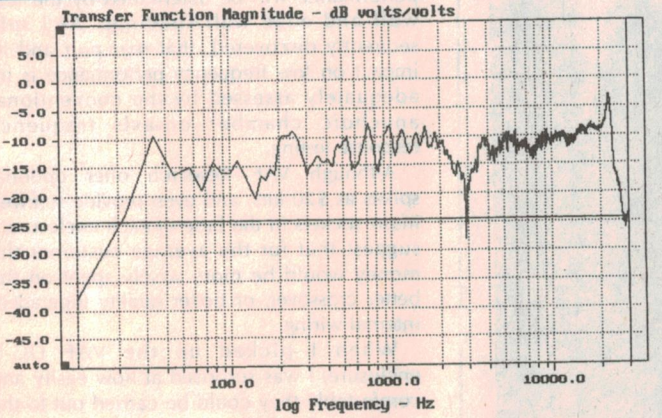
I placed the speaker cabinet on the turntable and away we went! Although the manufacture's literature claims +/-2dB frequency responses from 38Hz to 22kHz, I can't really support that optimistic claim. With a rear port, I had no hope of measuring that performance in a conventional anechoic room (i.e., a room with six anechoic faces) — and equally significantly, it can't be achieved in any normal test environment.

As you will observe from the level recordings measured at both one metre and two metres on-axis, the tweeter response between 4kHz and 22kHz comes pretty close to those +/-2dB deviations. That tweeter performance is impressive, and when one considers the cost of the DC-7 system, I'd describe the tweeters as outstanding, particularly in view of some far more expensive systems which I have tested, which are not nearly as good.

The bass response is entirely a function of what's placed behind the rear venting port. The mid-range frequency performance is however primarily a function of the angle between the central axis of radiation of the two speakers and the measuring microphone (or in the home listening situation, your head and your ears).

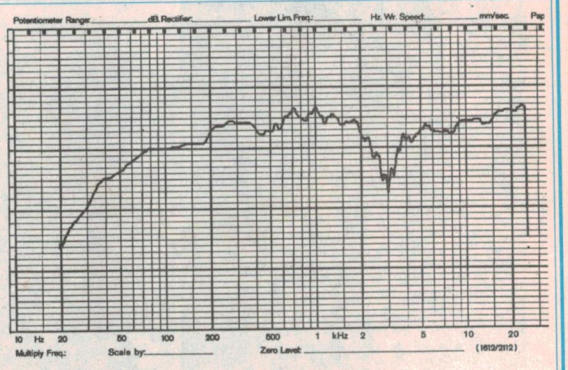
As I measured the 'on-axis' response of the DC-7 speaker system, my attention was drawn to the depth of the notch at the crossover frequency. Although Philip Vafiadis is proud of the crossover design, I feel it doesn't *quite* achieve all that is claimed. If the Ultra crossover is any better, then that option is most probably worth the extra money. I doubt however that just a change of wire gauge and reduced resistance in the inductors will obviate or minimise that crossover notch.

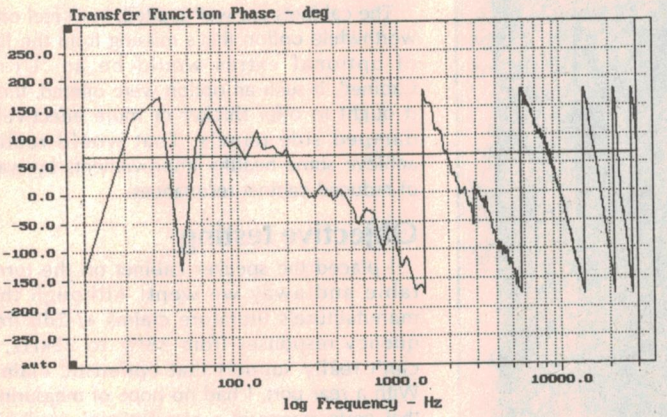
As my laboratory evaluation progressed, I observed that the polar plot performance is still very good, even at 10kHz. Yes, these



FREQUENCY RESPONSE OF VAF DC-7 LOUDSPEAKERS

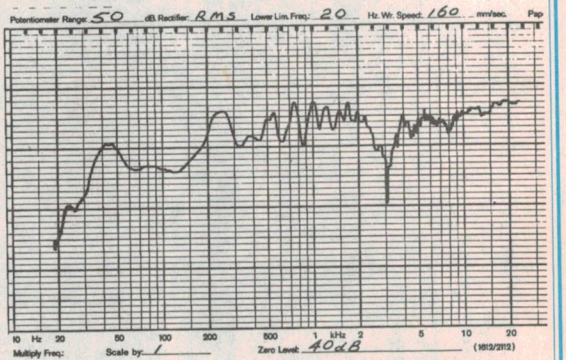
MEASURED AT 1m

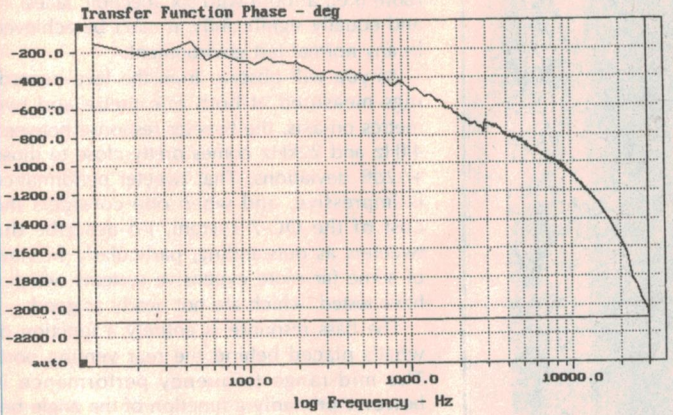




FREQUENCY RESPONSE OF VAF DC-7 LOUDSPEAKERS

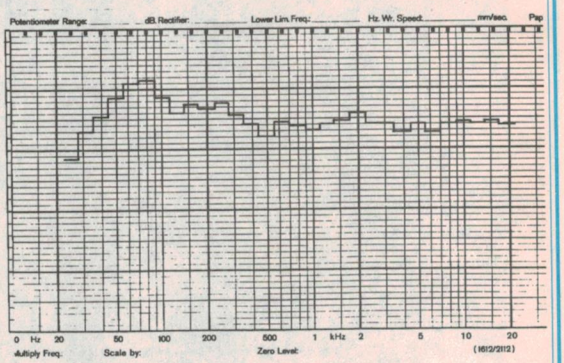
MEASURED AT 2m



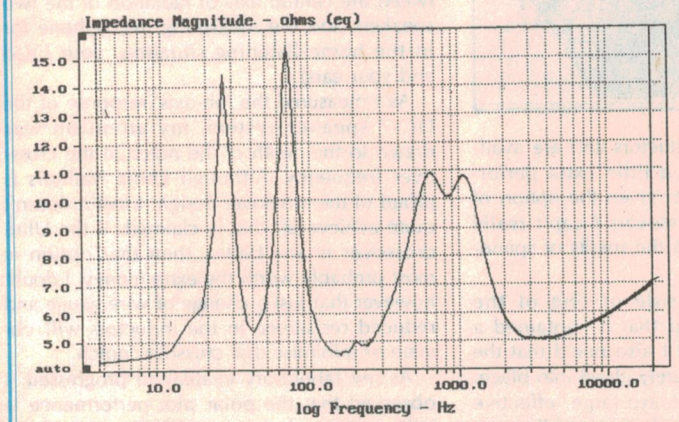


PINK NOISE ROOM RESPONSE OF VAF DC-7 LOUDSPEAKER @ 300mm FROM WALL

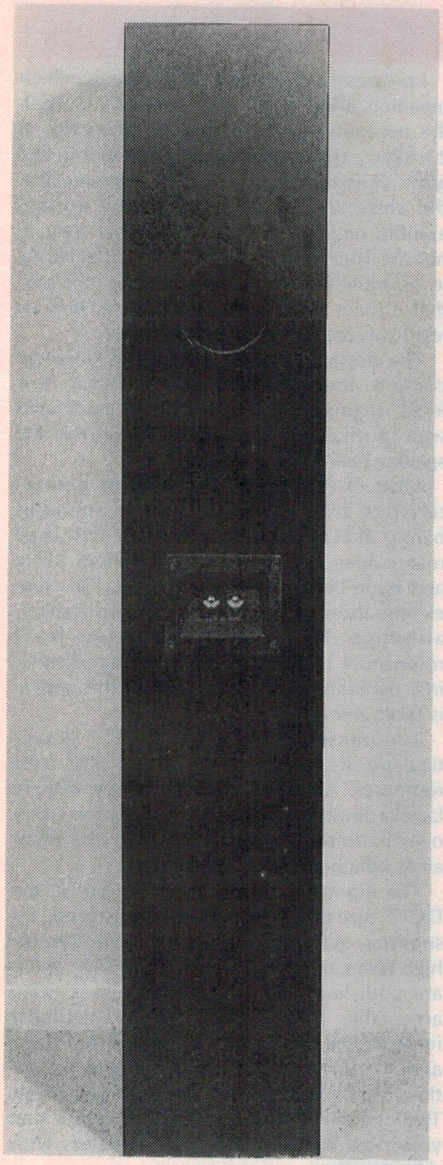
Dated 5-2-95



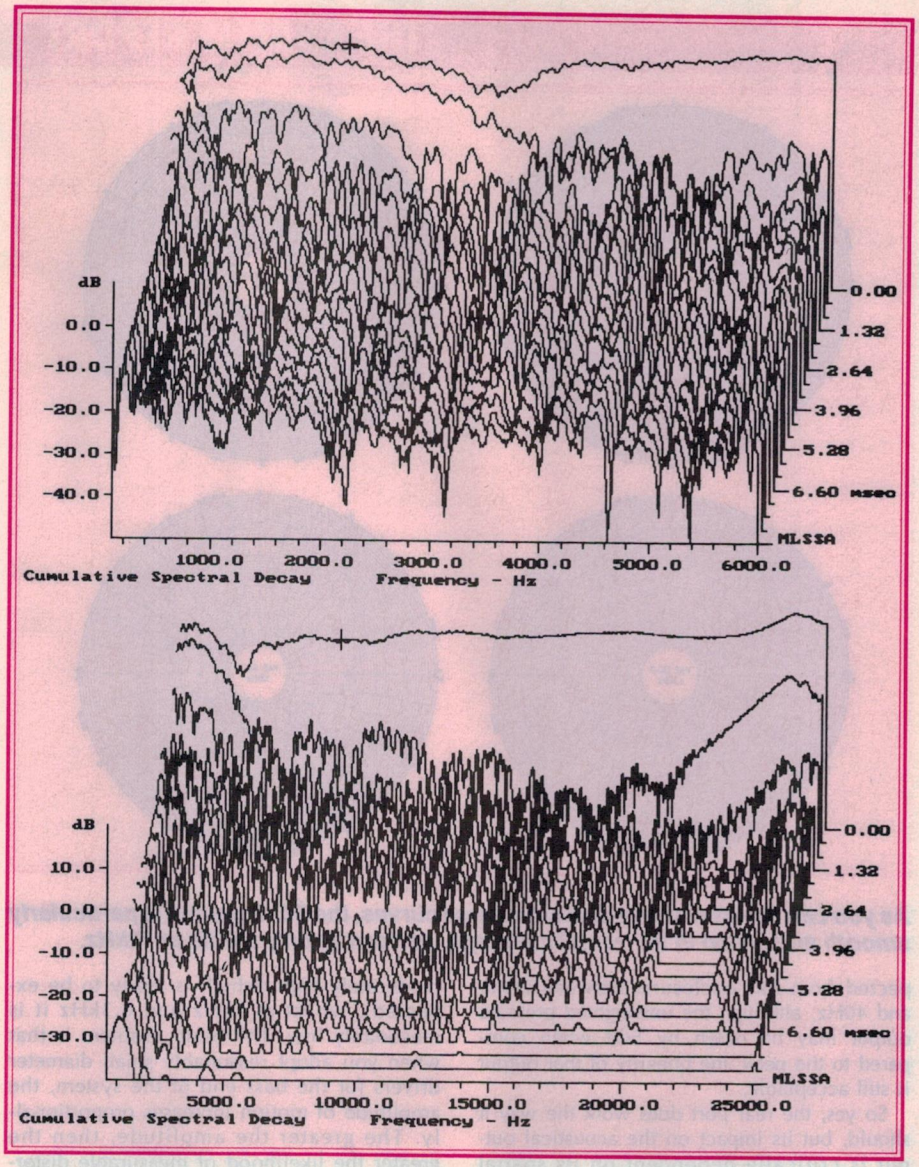
On the left are the plots of the VAF DC-7 system at 2m, measured using MLSSA. At top is the transfer function magnitude, with the discontinuous and continuous phase plots below. At the bottom is the magnitude of system impedance plotted against frequency.



Above are the frequency response curves of the system as plotted with the Bruel & Kjaer measuring equipment. At top is the on axis response at 1m, with the response at 2m in the centre. The lowest curve is the pink noise room response measured with the DC-7 cabinet placed 300mm in front of the rear wall. The performance is generally very impressive, apart from the small notch evident at almost exactly 3kHz.



As you can see from this rear view, a distinguishing feature of the DC-7 cabinets is a sizeable rear port.



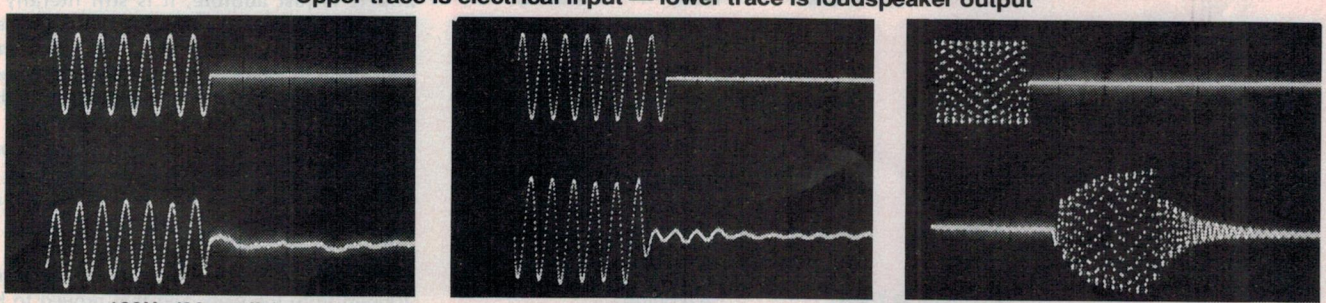
Here are the cumulative spectral decay or 'waterfall' response curves for the DC-7 system, with the top plot showing the spectrum up to 6kHz, and the lower plot showing the upper part of the spectrum.

VAFM-25 tweeters exhibit excellent characteristics, and will no doubt have the competition more than a trifle worried.

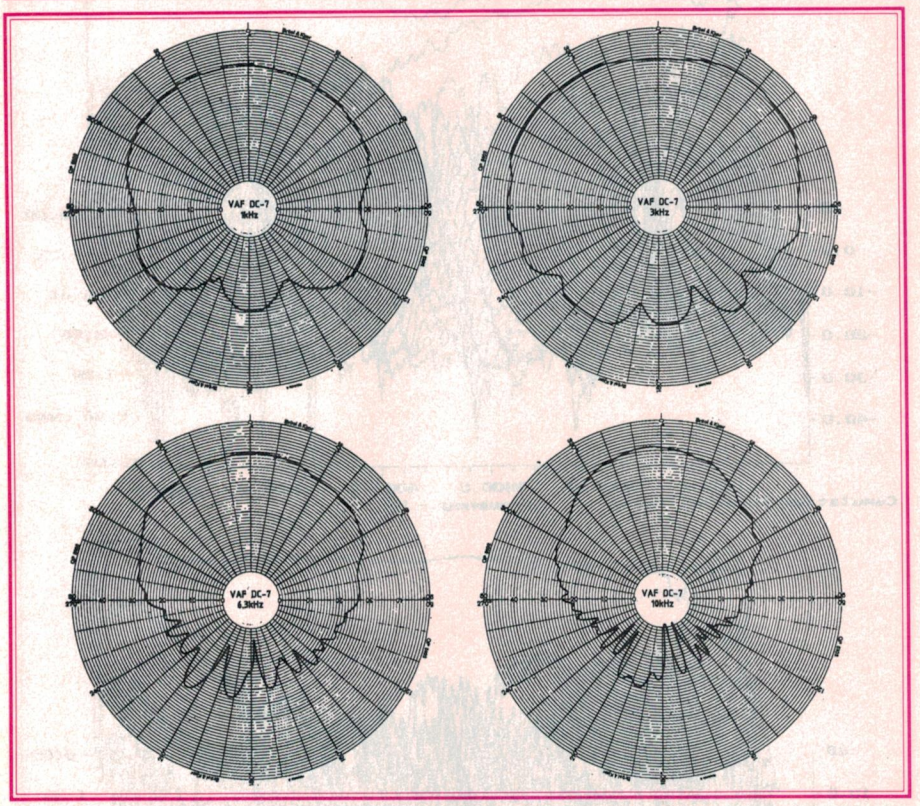
Before progressing with the next phase of the testing, I decided to remove the test speaker from the anechoic chamber, and set it up outside the chamber (in an outdoor situation) on its back 300mm above a reflecting plane. The presence of four side reflecting walls at distances of 2-4m from the speaker couldn't be avoided, but I felt I should find out what difference that energy emitted from the rear port makes to the total speaker output.

As I soon discovered, if one ignores the notches due to destructive interference, the performance from 60Hz to 20kHz is relatively smooth and far better than I would have ex-

Tone Burst Response of VAF DC-7 Mk II Loudspeaker System — for 90dB steady state SPL at 1m on axis
Upper trace is electrical input — lower trace is loudspeaker output



100Hz (20ms/div) 1075Hz (2ms/div) 23.6kHz (100us/div)



As you can see from these polar response curves, the DC-7 system is particularly smooth and broad in its frontal coverage, narrowing only a little at 10kHz.

pected from this enclosure. Between 20Hz and 40Hz, although the unweighted pressure output may be down by 5dB when compared to the peak, the linearity of that output is still acceptable.

So yes, the rear port does work the way it should, but its impact on the acoustical output is critically dependent on its spatial separation from the rear reflecting wall.

I returned the test speaker to the anechoic chamber to assess the distortion characteristics. The distortion at 100Hz was moderately high (which is really to be expected), whilst at 1kHz and 6.3kHz it is reasonably low. The basic problem is that when you adopt reasonably small diameter drivers for the bass end of the system, the amplitude of motion increases proportionally. The greater the amplitude, then the greater the likelihood of measurable distortion. At 96dB output at 1m, distortion becomes readily detectible, whilst at 100dB it is starting to become very obvious, even to an untrained ear.

Measured Performance of VAF DC-7 Loudspeaker System

Frequency response		40Hz - 22kHz +/-6dB		
Crossover frequencies		3kHz		
Harmonic Distortion at 1m		**90dB 100Hz**	**90dB 1kHz**	**90dB 6.3kHz**
	2nd	-30.2	-54.9	-47.3
	3rd	-41.5	-57.5	-53.0
	4th	-58.4	-	-
	5th	-	-	-
	THD	3.2%	0.22%	0.49%
Input impedance	63Hz		11.7 ohms	
	250Hz		5.1 ohms	
	1kHz		10.9 ohms	
	4kHz		5.2 ohms	
	8kHz		5.7 ohms	
	Minimum at 150Hz		4.6 ohms	

I progressed to the tone burst testing, which revealed another facet of the picture. With the exception of an ultra sonic resonance at 23.6kHz, these drivers do not exhibit any gross signs of ringing. The one example that did show up, is so far above the normal audible range, that you will neither hear it, nor are you likely to be adversely affected by it. Essentially the tone burst testing indicated that if there was any ringing present, then its level was reasonably well controlled.

The decay response spectra did however confirm the presence of significant low level ringing, which is primarily associated with the bass/mid drivers, and I suspect the speaker cabinet.

Most of these low level ringing characteristics are associated with frequencies below 3kHz. There are traces of low level resonances in the tweeter at around 4kHz and again between 5kHz and 7kHz. On close examination of the decay response spectra, although there are numerous low level resonances, none of these is all that disturbing, particularly when the cost of this system is taken into account.

The phase response of the DC-7 is particularly pleasing, as there are no nasty step responses. Although I am not happy with its lack of linearity, it is apparent that the crossover is doing a reasonable job in the other areas which are equally important.

The input impedance characteristics of the DC-7 speaker enclosure contained no surprises. Although there are two moderately high resonant peaks at 25Hz and 70Hz, these are both less than 15 ohms, which is quite acceptable. Even the basic lowest level input impedances of 4.5 and 5.0 ohms at 150Hz and 3 - 4kHz respectively are just about optimum for most modern transistor amplifiers. The one thing that should be noted is that you must not parallel these speakers with other speakers.

Listening tests

The pair of DC-7 speakers fitted comfortably into the boot of my car, and that evening I set them up for their first subjective evaluation.

Although they are inexpensive, the first and otherwise critical test with pink noise augured particularly well for what was to follow. I was gratified to find how smooth they sounded with pink noise input. Whilst the low frequency peak between 80Hz and 200Hz is just audible, it is still literally a moveable feast. The high point of that peak can be readily translated to another frequency, simply by moving the speaker into or out from its rear reflective wall (or away from the side wall).

The measured one-third-octave band room response with a 300mm rear wall spacing is particularly smooth. It may not be +/-2dB, as the VAF Research literature claims, but it is still good and impressive.

I moved the speaker out by another 200mm from the wall, and that proved to be the best position in my listening room in

terms of an overall smooth low frequency response. I have no doubt however that most people would place these speakers about 300mm or even closer to a rear wall, and so I present the graph for that situation.

Over the two weeks I had the speakers at home, I listened to more than 30 different discs with a wide range of program content. The first disc I auditioned was Wynton Marsalis' The London Concert, in which he plays some delightful Haydn, Hummel and Mozart baroque music (Sony Classical SK57497). Wynton Marsalis is one of the most outstanding trumpeters in the world, and this is an outstanding disc. His rendition of the Mozart Concerto for Trumpet & Orchestra in D Major is exquisite. I was pleased to hear and observe just how well the loudspeakers reproduced the sound. Although not 'true to life' the reproduction was a remarkably good rendition.

The human voice is always a more telling test than most musical instruments. For this test I used a new disc of Opera Highlights which features a pot-pouri of five acclaimed European opera stars (Capriccio 14-851). The singers I used were the counter-tenor Jochen Kowalski in 'Orpheus & Euridice' and Renato Bruson in 'Simon Boccanegra'. Their voices and the playing of the orchestras displayed some tonality and readily detectable differences between my reference speakers. Although the performance was generally good, I was aware of the dip in frequency output around 3kHz.

The last of the test discs I used was Dave Grusin in 'Discovered Again' (Sheffield Lab CD-5). This is a truly outstanding demonstration disc, and it contains exquisite tympani as well as some rollicking good bass content. The reproduction performance of the VAF speakers was very good. The music sounded true to life, and even the bass response, although a trifle muted, displayed no signs of gross distortion at output levels below 100dB.

When the price of these speakers is taken into account, I feel an even stronger comparative accolade is most probably warranted, rather than just 'good'.

The VAF DC-7 speakers are not the finest loudspeakers on the Australian market. However, if you are on a tight budget, at $749 a pair for the kit version with full insured freight at $29, you would be hard pressed to find better value for your money.

Hopefully VAF might soon offer an 'Ultra' cabinet with more heavily damped and stiffened side panels, coupled with a refined crossover which reduces the magnitude of that notch. If they elect to do that, then the opposition will be in shock, for then VAF may well have a true 'world beater' in their stable.

The dimensions of each DC-7 cabinet are 900 x 160 x 295mm (H x W x D). As mentioned earlier, the system (two cabinets) has an RRP of $749 for the kit version, and $945 fully assembled.

Further information is available by circling 240 on the reader service card, or direct from VAF Research at PO Box 380, Greenacres SA 5086; phone (08) 369 0669 or freecall 008-81 8882, or fax (08) 369 0634. ❖

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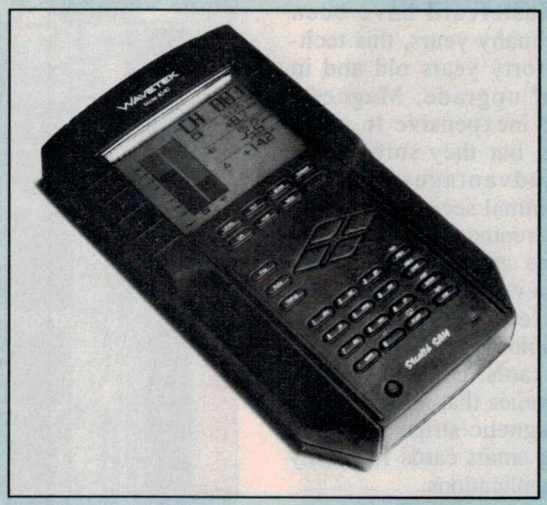

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READER INFO NO. 5

What's inside the new breed of

SMART CARDS

Around the world, conventional credit, debit and ID cards with their information stored in a magnetic stripe are being replaced by 'smart cards', which offer a much higher level of security thanks to an inbuilt microprocessor and memory. Many of the new cards can be interrogated by radio, while they're still in your pocket or wallet. Here's a rundown on the way they work.

by ROBERT OWEN

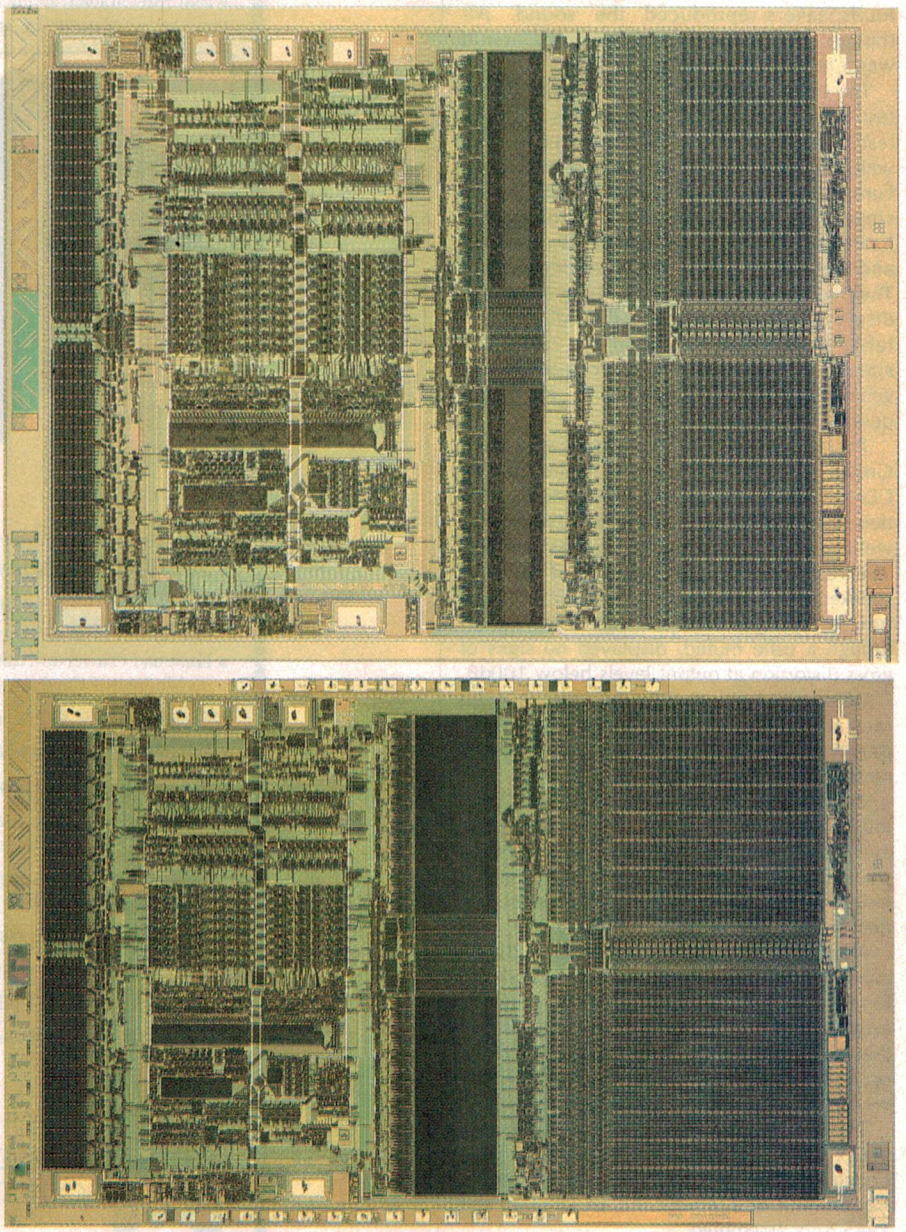
Although magnetic stripe cards like Visa or Mastercard have been widely used for many years, this technology is now forty years old and in serious need of upgrade. Magnetic stripe cards are inexpensive to make and easy to use, but they suffer from two major disadvantages: lack of memory and minimal security.

In order to overcome these problems, many companies are now turning to 'smart cards' as a way of providing versatility, more features and greater security than would be obtainable using magnetic stripe cards. Because of their versatility, companies that have not previously used magnetic stripe cards are also considering smart cards for many non-traditional applications.

Smart cards are the same size as conventional credit cards but, instead of storing information on magnetic stripes, the information is stored on a 1mm-square integrated circuit embedded in the plastic card. In this article we will only look at smart cards in which there are both a microprocessor and memory contained on the chip embedded in the plastic card.

A typical smart card today uses CMOS technology and consists of an eight-bit 5MHz microprocessor, 16K bytes of ROM, 288 bytes of RAM and up to 8KB of EEPROM. The card's operating system is stored in ROM and the microprocessor uses the RAM as a temporary working area, while user information that can be altered is stored in the EEPROM. A basic smart card costs between $10 and $20, but more sophisticated cards can cost upwards of $35. This compares with a cost of about $1.20 for a magnetic stripe card.

Smart card chips are designed to be very secure against illegal reading or falsification of customer data. For example, smart cards are made using only one integrated circuit; if two integrated



These photographs show the layout of smart card chips ST16301 and ST16612, from SGS-Thomson. The EEPROM user memory is located on the right hand side of both chips. The ST16301 (top) has 3K of ROM and 1K of EEPROM, while the ST16612 (below) has 6K of ROM and 2K of EEPROM — note the extra chip area required for a doubling of the ROM and EEPROM capacity.

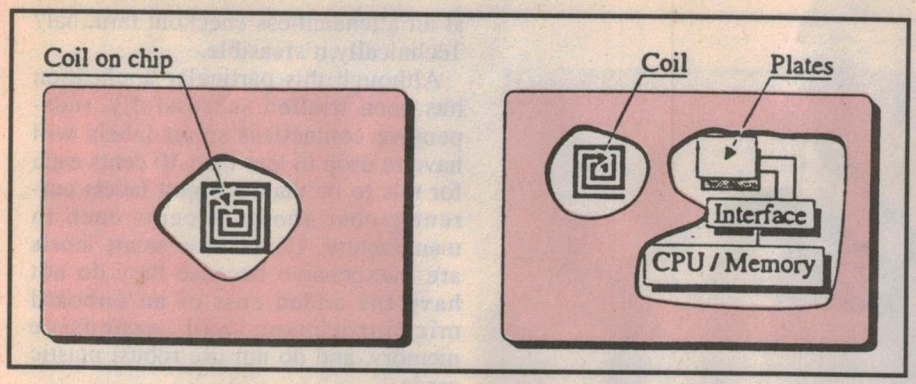


Fig.1: The position of the antenna or induction coil on contactless smart cards. The coil can be either separate, or part of the chip. (From Smart Cards, Artech House).

circuits were used, then it would be possible for an electronic eavesdropper to listen-in on data being transferred on the bus connecting the two chips...

As a further measure to protect data held in smart cards, dummy 0's and 1's can be interlaced pseudo-randomly with data held in memory — the interlacing pattern being known only to the smart card's onboard microprocessor. For example, data of '10010110' could be stored as '0101011010101', with a different set of dummy 0's and 1's being used in the next line of data.

Also, it is possible with precision equipment to shave away the case of an integrated circuit to reveal the underlying electronic circuitry, and then use an electron microscope to read the contents of its memory.

An electron charge being present signifies a '1', while no charge present signifies a '0'. To overcome this threat, smart card manufacturers design their integrated circuits so that if the plastic casing is removed, the contents of memory automatically self destructs.

Using the onboard microprocessor, enhanced security and password verification procedures can be implemented including Public Key Cryptography or DES. A combination of all the security techniques outlined above make smart cards a very formidable security device to break.

Even though the total onboard memory of a smart card is only about 24KB, smart card integrated circuits are state of the art components. The various memory types and the microprocessor must all be fabricated on a single chip using CMOS technology.

The card must still work when dirty, it must be able to operate reliably despite fluctuations in its power and clock frequency, and data must still be stored correctly even if the card is withdrawn from a card reader halfway through a write-to-memory operation. Also the 1mm square integrated circuit must be embedded in a plastic card exactly the same size as a conventional credit card. These requirements ensure that smart cards are designed using state of the art technology.

Photographs 1 and 2 show the layout of integrated circuit chips that contain 1KB and 2KB of EEPROM. The EEPROM is the large area on the right hand side of the photographs. It can be seen that to increase the amount of EEPROM from 1KB to 2KB, this substantially increases the amount of surface area taken up on the integrated circuit. Because of this, smart card manufacturers are severely restricted in the amount of user data that can be stored on a card.

How they work

We have looked at the structure of a smart card, but how do we read or write to the card? There are two methods: the first places up to eight gold contacts on the surface of the card, as shown in Photo 3. These contacts are used as follows:

Contact 1: +5V power
Contact 2: Reset
Contact 3: Clock
Contact 4: Not used
Contact 5: Ground
Contact 6: Program internal memory
Contact 7: Card I/O
Contact 8: Not used

Because contacts 4 and 8 are not used, some manufacturers only place six gold contacts on their cards. Using these gold contacts, it is easy for a card manufacturer to design a terminal where the card is inserted into the reader, much like the banks' ATM machines in use today.

A more sophisticated method of communicating with smart cards, already widely used, involves *contactless* smart cards. The contactless smart card does not have any gold contacts but instead uses radio not only to read and write to the card, but also to provide power and the clock frequency.

A contactless smart card would have embedded in the plastic card a small strip antenna connected to the integrated circuit. The card IC would then use the incoming RF to receive and transmit data at rates up to 19.2Kb/s whenever the card was within — say — one metre of the terminal.

A good example of this would be employee identity cards which could be interrogated whenever the employee entered a particular building or a restricted area. The interrogating terminal would be mounted on the wall near the entrance and connected to the building's security computer.

Interrogating contactless cards using RF is easy enough, but where does the card get its power from? By embedding an induction loop in the plastic card, the RF transmitted by the wall mounted terminal would induce a voltage in the induction loop, which can be used to power the card's integrated circuit. The clock frequency can also be obtained in this way.

For some applications though, smart card manufacturers are using wafer thin flexible batteries embedded in the card; this has the disadvantage of requiring a slightly thicker card. Batteries typically have a lifetime of two or three years before the card has to be thrown away.

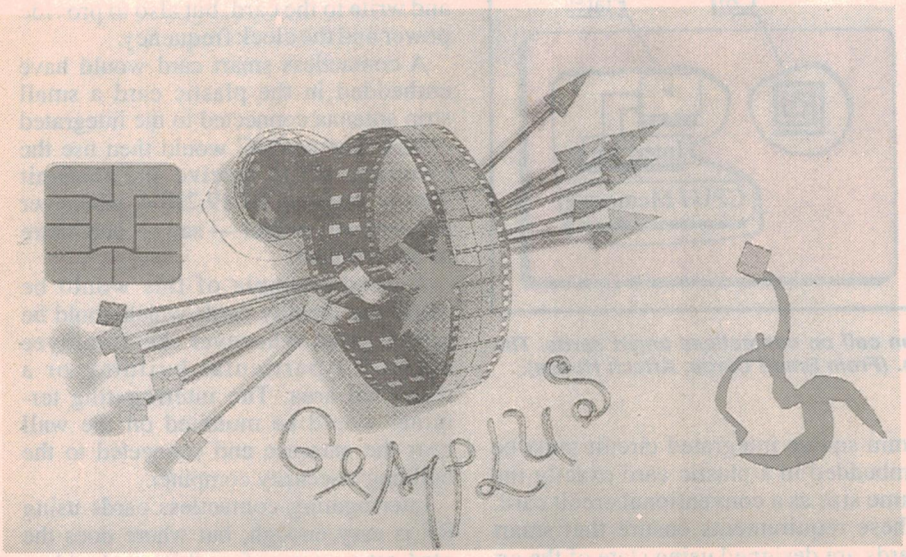
Many uses

The use of smart cards is booming. The banks are now planning to replace existing magnetic stripe credit cards with gold contact smart cards, but the cost of upgrading all those magnetic stripe card readers is going to be expensive. Outside the financial sector, many companies are also looking at smart cards to solve some of their problems.

For example, many public transport companies now use contactless cards for season tickets. If you walk up to a turnstile with a contactless smart card season ticket in your wallet, the turnstile will open. If you are not carrying a season ticket, the turnstile will not open unless you insert the correct change.

Because smart cards use the same size plastic card as conventional credit cards, many companies are using combined smart card/magnetic stripe cards. These combined cards have both an onboard microprocessor and gold contacts for smart card applications, and have a magnetic stripe on the back for conventional applications.

But the most novel use for contactless smart cards is in supermarkets, in place



A photograph of a Gemplus smart card. Note the six gold contacts on the surface of the card (centre left), used for power and I/O.

of labels containing bar codes. If each item is labelled with a cheap 'smart label', simply wheeling a trolley of goods past the checkout terminal will allow the terminal to interrogate each item in the trolley automatically without the need to unload each item. The terminal will then provide an itemised bill for the customer to pay.

Would payment then be made automatically, using a contactless credit card still in the customer's wallet, once the PIN number had been spoken into a voice recognition system at an attendantless checkout terminal? Technically, it's feasible.

Although this particular application has been trialled successfully, inexpensive contactless smart labels will have to drop to less than 10 cents each for this to be viable. Smart labels currently cost about 20 cents each to manufacture. Contactless smart labels are inexpensive because they do not have the added cost of an onboard microprocessor and expensive memory, and do not use robust plastic cards.

As explained above, smart cards are state of the art devices that are going to gain widespread use in many applications. In order to make their use even more widespread, many companies are combining several application onto a single card — like the combined use of GSM mobile phone SIM card, petrol card and credit card. Using smart cards, the number of cards in your wallet may for the first time begin to decrease.

Finally, if you'd like to know more about smart cards, here's a reference for further reading: *Smart Cards*, by Jose Luis Zoreda and Jose Manuel Oton. Artech House, 1994; ISBN 0-89006-687-6. ❖

ELECTRONICS AUSTRALIA'S

READER INFORMATION SERVICE BBS

As part of its service to readers, *Electronics Australia* has now set up a Reader Information Service Bulletin Board System (BBS). This makes available a wide range of useful information, for convenient access and fast downloading by readers with a personal computer and modem. Here's an idea of what's currently available:

- Software needed for recent PC-based EA construction projects
- Project index files for EA and ETI construction projects
- Recent notes and errata
- Useful public domain and 'shareware' software for electronics and amateur radio
- General interest shareware utilities

The *Electronics Australia* Reader Information Service BBS is ANSI-compatible and is currently operational from 7am to 2am each day, seven days a week, on (02) 353 0627. Your modem can be set to 300, 1200 or 2400bps full duplex, with a data format of '8-N-1' (eight data bits, no parity and one stop bit). So avail yourself of the information it provides — there is no cost for the service itself. Your only outlay will be the usual cost for a phone call.

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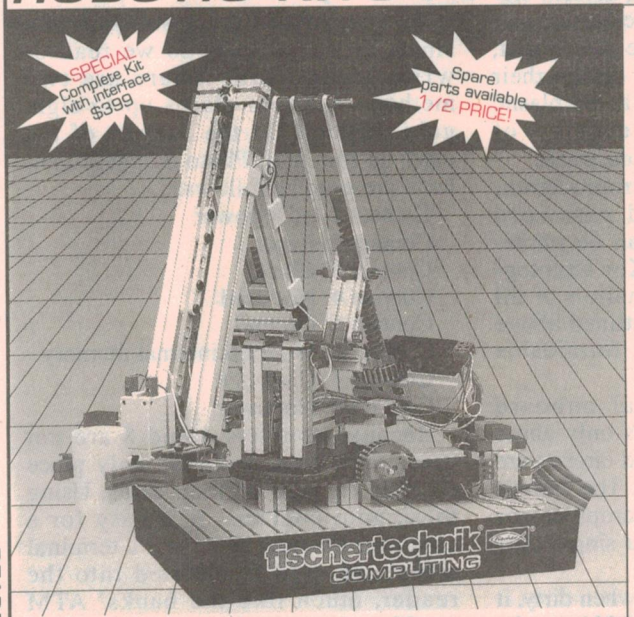

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Don't let your knowledge of electronics go to waste!

HOW ABOUT TEACHING ELECTRONICS AT HOME?

Here's a short article explaining how engineers, scientists and technicians who have retired (or simply have some spare time) can play an important role in helping more of Australia's young people learn and enjoy electronics. This can also be a very satisfying way to 'stop your knowledge going rusty', as the author explains...

by DR ALLAN MORTLOCK

There are lots of us who have had an interest in electronics for many years. As boys and young men we enthusiastically constructed our first crystal sets, then one-valve regenerative radios (remember the type 30 triode valve?), leading on to amplifiers, transmitters and who knows what.

Perhaps our careers subsequently led us into other areas of electronics as well, or it may have remained just a hobby — but somehow with much less time to pursue in the detail we once did.

Now, perhaps in retirement, we have the time to renew our interest in the subject and to delve into the advances made over the years. Having to teach the subject gives a positive incentive to do this in full detail!

There are young people in the senior years at secondary school who, as part of their courses in physics, need to be led through elementary electronics. Topics such as electrostatics, electric fields of force, electrical potential, magnetism, electric current, ohm's law, combinations of resistors, capacitors, combinations of capacitors, inductors, combinations of these, LCR circuits, semiconductors, junction diodes, Zener diodes, rectifiers, transistors (PNP and NPN), and so on form the core of the subject at this level.

Students at TAFE colleges doing specific courses in electronics would, of course, take the subject much further. Operational amplifiers, reactance, oscillators, coupled circuits, transmission lines, aerial design etc., are but a few of the topics which would need to be dealt with there.

Some of these young people can need help, through individual tutoring and hands-on contact with associated equipment, to improve their understanding of the subject. Often in class they don't understand something that is being explained by the teacher, but do not feel able to voice their problem in front of the class. In a one-to-one situation (tutor/student), this problem tends not to arise.

Again there is often a lack of good equipment to demonstrate the concepts under discussion. There is an old Chinese saying: 'To read is to forget. To see is to remember. To do is to understand.' In other words building and trying out circuits yourself is the best way to learn.

This is where *you* can be of help, through establishing a teaching facility at your home. This can be a room specially set aside with desk, books, work bench, and a range of appropriate equipment. One such room is shown in the photo, with a young student at work assembling a circuit.

At the secondary school level, the equipment need not be sophisticated. The 'ScienceFair' electronic experiment packages marketed by Tandy are reasonably comprehensive, well presented, and not expensive. Indeed, in a sale, they represent an excellent buy.

At least one separate 0-1mA meter movement is necessary so one can construct voltmeters and ammeters from scratch. And, of course, a couple of versatile multimeters so circuits can be explored. If you can afford a CRO, that will be a great help.

How can one draw the attention of needful students to your facility and expertise to teach? By advertising on notice boards at colleges or, if you want to go to the expense, in the Yellow Pages of the local telephone directory.

It is appropriate and expected that you charge a fee for your instruction. How much depends on you. Contact time is in hourly periods — say once a week, for each separate student, but sometimes more often as examinations draw near.

Having such a facility operating in your home is a tax advantage, as part of the operating expenses of your home become tax deductible. Also the cost of the equipment you use is deductible on depreciating basis.

Overall the activity will be found to be rewarding on both a financial basis as well as spiritually, and is to be recommended. You can feel very wanted again!

Dr Allan Mortlock is a part-time member of the Physics Department at the Australian Defence Force Academy in Canberra, and an 'Explainer' at Questacon, also in Canberra. ❖

NEW BOOKS

Modem companion

OFFICIAL HAYES MODEM COMMUNICATIONS COMPANION, by Caroline M. Halliday. Published by IDG Books Worldwide, 1994. Soft covers, 235 x 188mm, 462 pages. ISBN 1-56884-072-1. RRP $59.95.

Data communications is certainly expanding and developing at an explosive rate. Gone are the old days of manual 300b/s modems and simple 'dumb terminal' programs; now it's almost essential to have an auto-dialing, high speed modem, plus a comms package with full repertory dialing, multiple file transfer protocols and other facilities built in.

US author Caroline Halliday has written this new book to guide the reader through the data comms maze, and although the title links it to the Hayes company and its modems, Hayes' pioneering role and the way its modem command language has been adopted by so many other firms means that the book actually has a much broader scope.

The author is herself a graduate electronics engineer and PC expert, but she has endeavoured to explain basic data comms, modem operation and configuration, file transfer protocols, BBS systems and so on, in language that can be understood by almost everyone. And she seems to have succeeded remarkably well, I believe, producing a book that should be of value to both experienced users and beginners alike. It's clear, concise and very readable.

A bonus is that a 'limited' but fully functional version of Hayes' comms software *Smartcom for Windows* is bundled with the book, on a 3.5" floppy disk.

The review copy came from Hayes Microcomputer Products (Australia), but the book is distributed here by Woodslane, of 7/5 Vuko Place, Warriewood 2102; phone (02) 970 5111. (J.R.)

Sound recording

AUDIO RECORDING AND REPRODUCTION, by Michael Talbot-Smith. Published by Butterworth-Heinemann, 1994. Soft covers, 134 x 215mm, 190 pages. ISBN 0-7506-1917-1. RRP $35.00.

According to its back cover, this book aims to give the reader a 'simple and straightforward approach to audio techniques, detailing technical and practical information for those with no specific training in the subject'. The author draws 'on over 30 years' experience at the BBC and throughout the broadcasting industry'.

It seems to travel the middle road, with a broad discussion of sound and sound equipment. Predictably the first chapter deals with sound waves, with the next two discussing hearing and acoustics. These three chapters occupy 36 pages, and the fourth, on microphones takes 20 pages. The fifth chapter is devoted to *using* microphones, and all up nearly 15% of the book is about microphones and their use.

The remaining chapters discuss loudspeakers, stereo sound, sound mixing equipment, tape recorders, digital audio, public address systems, sound effects and safety.

The book contains a lot of basic and useful information, and presents most of it in an active voice — which sometimes gets a little patronising. Many chapters are divided into two parts: part 1 for the non-technical reader and part 2 with greater reference to technical terms.

The technical content in these chapters is generally not enough for a sound engineer or student, but adds interest for the technical reader. In the main, though, the book is more suited to a non-technical reader. I doubt if such a reader will really be able to use this information in a practical sense, but it will certainly give a good foundation for further studies.

The review copy came from Butterworth-Heinemann, PO Box 345, North Ryde 2113. (P.P.)

Servicing CD players

UNDERSTANDING & SERVICING CD PLAYERS, by Ken Clements. Published by Butterworth-Heinemann (Newnes imprint), 1994. Hard covers, 253 x 194mm, 202 pages. ISBN 0-7506-0934-6. RRP $69.95.

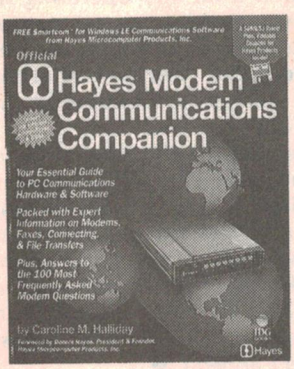
A couple of decades ago, electronics servicing mainly involved analog equipment like TV and radio receivers, and the odd hi-fi amplifier. Nowadays the service technician is facing a much wider range of equipment, much of it based heavily on digital technology. And although it's generally more reliable, when it *does* need servicing the faults can need specialised knowledge to track down.

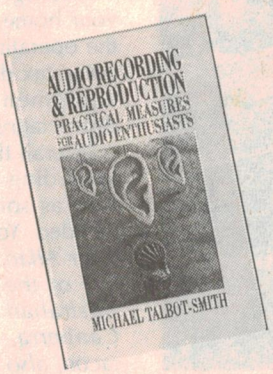
This book is written specifically for servicing people, to provide all of the basic information needed to repair CD players. The UK-based author has extensive personal experience in this area with both Sony and Pioneer, and has also run technical training courses on CD player servicing.

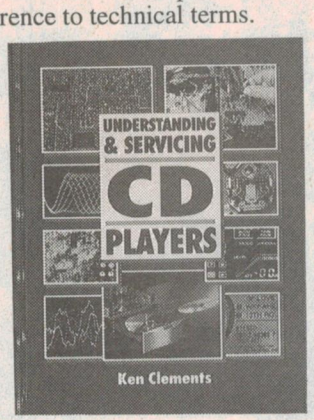
In the early chapters he explains the basics of CDs and player operation, following this with sections describing typical player circuits, testing and adjustment techniques, system control and faultfinding procedures.

The text is easy to read, and well supported by diagrams and other illustrations. There's also a couple of data appendices, one explaining the basic principles of digital signal processing, and the other dealing with health and safety. Overall, a book that should be of great value to anyone involved in CD player servicing.

The review copy came from Butterworth-Heinemann Australia, of PO Box 5577, West Chatswood 2057; phone (02) 372 5511. (J.R.) ❖







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SPYING ON THE SUN

After a troublesome birth and a journey taking over four years, the European Space Agency's solar research spacecraft Ulysses is now orbiting and surveying the Sun, and sending back streams of valuable data via NASA's Deep Space Network. Here's an update on the mission.

In the July 1991 issue of *Electronics Australia*, we gave the background story on the development and launching of the ESA's Ulysses space mission, which had then just begun its epic journey to explore the polar areas of our Sun. This story is intended to provide an update on the mission, as well as further information on the spacecraft and its payload of scientific experiments.

After an eventful four year flight which took it out of the ecliptic plane with assistance from the planet Jupiter, Ulysses arrived at the south solar pole in June 1994 and is now moving towards the Sun's north pole, carrying out a comprehensive scientific survey in the process. This will greatly expand our understanding of the solar system's only star.

Recapping on the basic details of Ulysses, the spacecraft consists of a main 'bus' measuring 3.2 metres in length, 2.1m in height and 3.3m in width. Weighing in at only 370kg, Ulysses was one of the lightest payloads ever to be launched by a space shuttle.

The experiment payload that Ulysses carries consists of nine instruments, which cover the full range of solar physics being addressed by the mission. Spatial scanning is required for most of the instruments and because of this, the spacecraft is a spin- stabilised one which rotates at five revolutions per minute.

To minimise the interference that comes from the radiation of the Radioisotope Thermoelectric Generators (RTGs) which power the spacecraft, the experiments are stored in a bay that is as remote from the RTGs as practical. The electromagnetic compatibility requirements of the experiments are met by placing the power and data-handling subsystems, which generate electrical noise, in a separate bay.

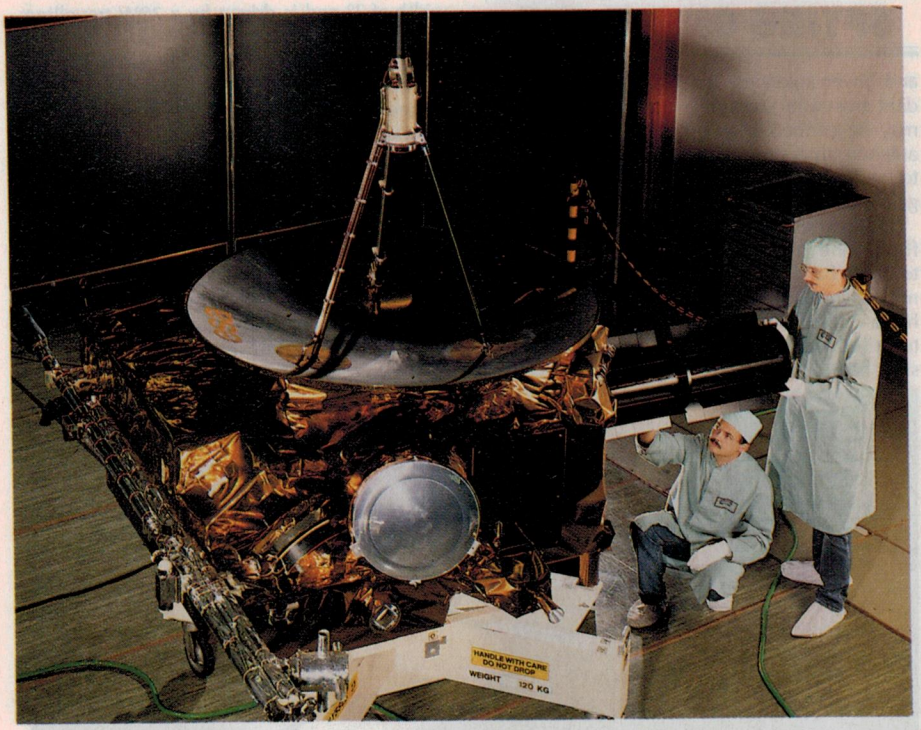
The use of the dedicated experiment bay also solved the 'field of view' requirement of the experiments, with regard to the reflector of the High-Gain Antenna (HGA) — which will provide communication with Earth. The HGA must be mounted concentrically with the spacecraft's spin axis. From the experiment bay, the required directions of view are available beyond the edge of the reflector dish.

This basic configuration is responsive to the experimenter's need for a radial boom to carry magnetometers. The boom has been placed opposite the RTGs, and has also been used to locate several sensitive experiments further from the RTGs than would be possible within the main spacecraft body.

The physical configuration adopted to meet these diverse mission and experiment requirements consists of a single main platform of aluminium honeycomb which provides a mounting service for all of the electronic units and for the Reaction Control Equipment (RCE), with its centrally mounted tank containing 33kg of monopropellant hydrazine fuel. Four vertical longerons provide support for the top cover and for the bottom plate, which also serves as a thermal radiator.

The longerons provide the interface to the Upper Stage during the launch phase, by means of four feet below the radiator. For ground handling, they have four attachment points at their upper ends. The longerons carry aluminium honeycomb side panels which act as shear panels to steady the structure. The addition of bracing struts between the longerons and main platform produces a fixed and stable assembly.

Ulysses' spin axis lies through the centre of the four longerons. The 1.65-metre diameter High-Gain Antenna dish is mounted on this axis above the upper cover, on a braced tripod fixed to the main platform. The axis system has its origins at the spacecraft's centre of gravity and is aligned with the spin axis and to the RTG centre line.



Left:The spacecraft Ulysses undergoes final testing at ESA's research and technology centre ESTEC in Noordwijk, The Netherlands.

Opposite: An artist's impression of ESA's Ulysses spacecraft on its journey to the Sun. Ulysses is the first spacecraft ever to take measurements over the poles of the Sun.

Nuclear power source

Providing the power source for Ulysses is the Radioisotope Thermoelectric Generator (RTG) system, which is similar to those used previously on the Pioneer, Voyager and Galileo spacecraft. RTGs are used for deep space missions, as using solar panels is not practical because of the distance from the Sun that these spacecraft are covering. RTGs produce electricity for the spacecraft by the natural meltdown of plutonium 238, which is converted to 500 watts of electricity — sufficient to operate the spacecraft and its scientific instruments during its expected lifetime of eight years.

The RTG is carried on a braced flange, supported from the edge of the main platform opposite the experiment bay. The radial boom is strapped to brackets fixed to the main platform at the edge of the experiment bay. After the spacecraft is placed into orbit, the straps will be released and the centrifugal force generated by the spacecraft's spin will carry the boom out and latch it into a deployed position.

There is a 72.5-metre wire boom in the plane of the central platform and at right angles to the RTG and radial boom. This comprises two separate 36 metre long, thin ribbon, metallic antennae independently deployed using centrifugal force from the brackets two metres apart, which also carry Reaction Control Equipment thrusters.

The final significant element of the configuration is the axial boom. This is a rigid spar which is approximately two centimetres in diameter which extends 7.5 metres along the spin axis, away from the high-gain antenna. The spar was designed to be deployed by unwinding it away from its storage drum, a month into the mission when the wire booms would also be deployed.

Visible externally on the main body is the spacecraft's thermal finish. The top and all four sides of the main structure are covered with a multilayer thermal blanket. This is a very thin electrically conductive layer of indium tin oxide, required by some instruments, laid over the kapton external surface which gives it a golden appearance.

Communications

Ulysses' communication's systems include two S-band receivers, two five watt S-band transmitters, two 20 watt X-band transmitters, two small low-gain antennae and the high-gain antenna.

The spacecraft receives commands from Earth on a frequency of 2111.607MHz in the S-band and transmits on either 2293.148MHz or 8408.209MHz in the X-band.

During the launch and early orbit when Ulysses was only a short distance from Earth, communication was via up and downlinks in S-band through hemispherical coverage, upper

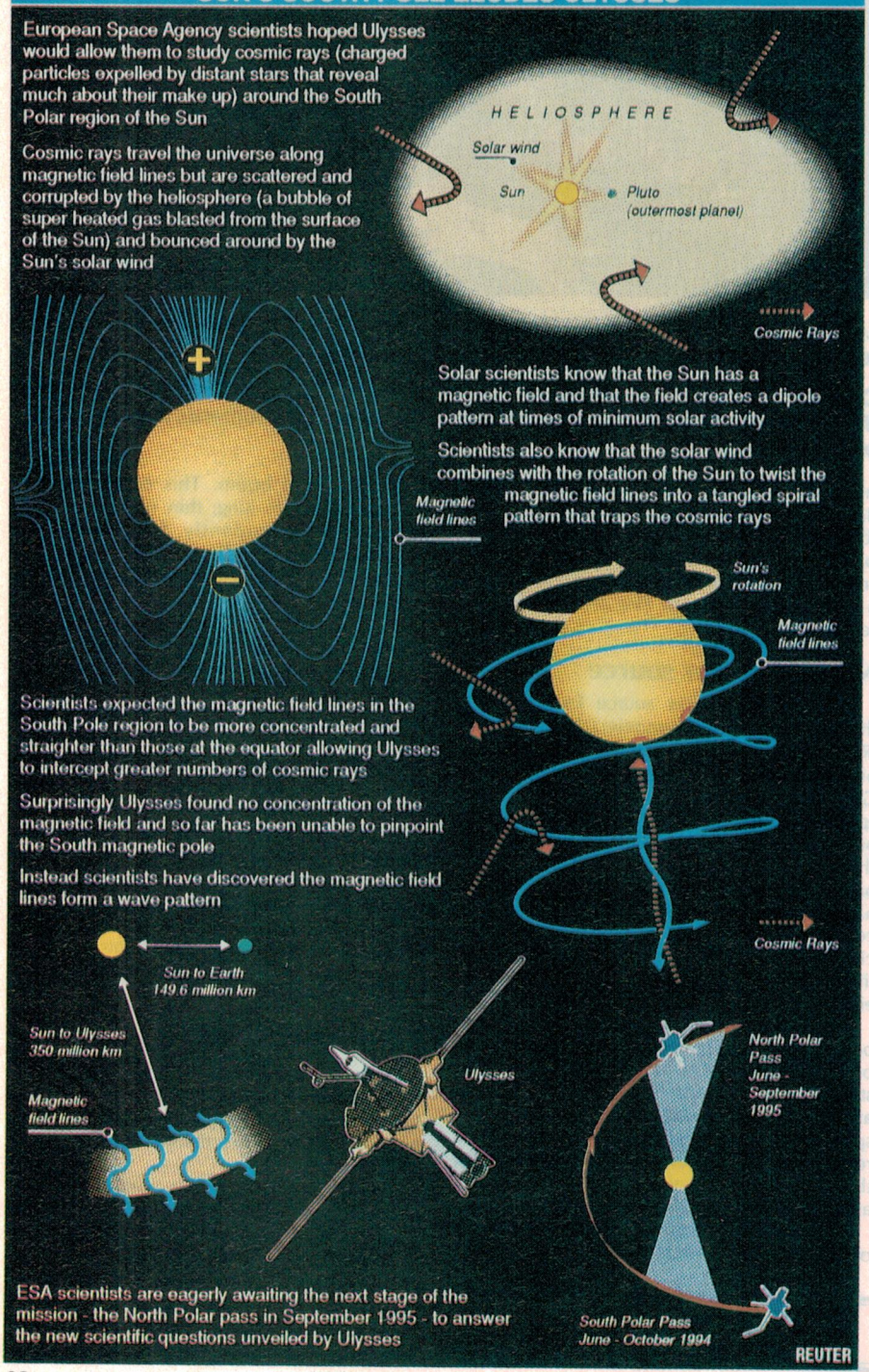
by KATE DOOLAN

and lower antennas. Transmission is by redundant five watt solid-state transponders, which may be connected to either the rear low-gain antenna on a short base below the radiator, or to the forward unit which is on top of the high-gain antenna feed.

Once the spacecraft had settled into its flight, the high-gain antenna was pointed towards Earth and S-band signals were transmitted through this high-gain system, which has a 3dB beamwidth of 10°. Then as Ulysses travelled further from Earth, this downlink was switched to X-band, where it has a 3dB beamwidth of 2° and is driven by a 20W travelling-wave tube.

A special feature of the high-gain antenna is its ability to measure the offset of the spacecraft's spin axis from the direction of the ground station by the so-called 'conscan' system. This is accomplished by means of an offset of 1.8° between the S-band antenna pattern and the spin axis, which results in a measurable variation in the uplink signal strength as the spacecraft rotates. Processing within the spacecraft's Attitude and Orbit Control Subsystem (AOCS) gives the offset magnitude and direction, which is either transmitted for ground analysis or employed in a closed-loop control system to minimise the offset.

SUN'S SOUTH POLE ELUDES ULYSSES



Data handling systems

The data-handling subsystem processes all commands from the ground and formats data from the experiments and subsystems, for transmission either in real time or after storage in a tape recorder. Recording and playback of data is controlled by the microprocessor equipped Remote Control and Interface Unit (RCIU). The recorders themselves are operated in start/stop mode for recording and playback of complete data formats.

The decoder distributes either direct commands to the user or serial commands to be processed by the Central Terminal Unit (CTU) and further distributed via the Remote Terminal Unit (RTU) which is the main interface unit for distribution and collection of signals or data on board the spacecraft. All automatic manoeuvres, whether routine or emergency as well as major reconfigurations, are initiated by the microprocessor-controlled Central Terminal Unit, which also contains a specially protected memory and a continuous self-checking capability for the datan handling subsystem.

Due to the special nature of the Ulysses mission, the data handling subsystem has a number of unique functions. Since Ulysses was scheduled to reach more than three billion kilometres from Earth, it was essential to have a low data rate (16 bits per second) for commanding in order to ensure reliable information. Also provided was a validation system, to ensure that critical commands are checked prior to execution. Although it is possible to send commands for immediate execution, the normal mode will be to 'time tag' them for execution within the range of 32 seconds to 24 days after receipt.

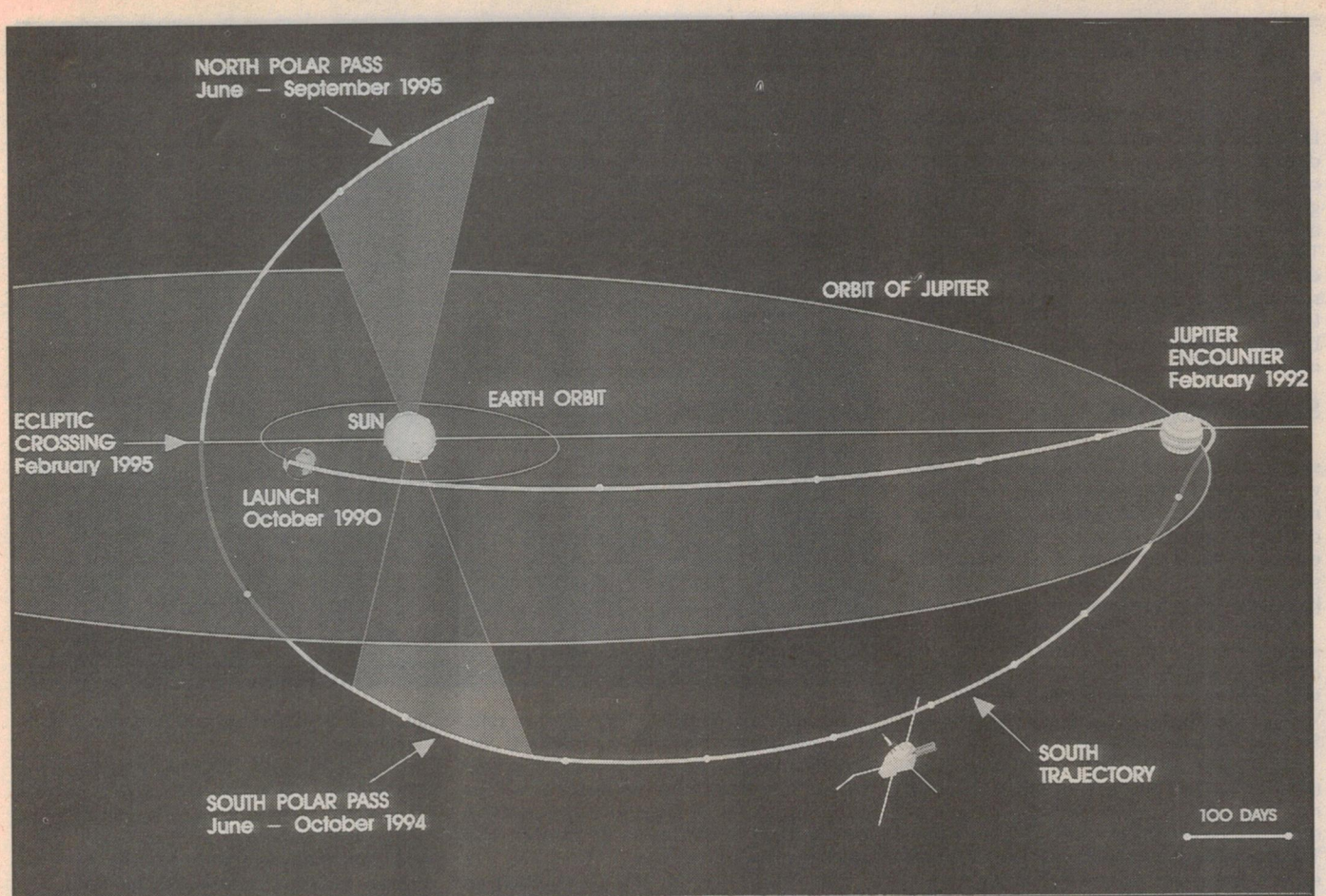
There is a diversity of telemetry formats and bit rates, to maximise scientific data transmission within the radio link constraints and to ensure the retrieval of data stored during non-tracking periods. The onboard storage comprises two magnetic tape recorders, each of which has a capacity of 44 hours at 256b/s. The data is subsequently transmitted to the ground mixed with real-time data.

The spacecraft's science telemetry is obtained from the experiment sensors and processed within the experiment data handling units prior to passing to the On Board Data Handling (OBDH) subsystem. There is also experiment and subsystem housekeeping data which is passed directly to the OBDH.

Within the subsystem, the data is transformed into one of three formats. The normal format is the 'science' format, which contains scientific data with limited housekeeping data. However when necessary, 'housekeeping' or 'emergency' formats can be called up if spacecraft or instrument health needs to be analysed in more detail. The formatted data is then serialised into the bit rate and convolutionally encoded prior to being passed to the transmitter for downlinking to Earth.

During periods when the spacecraft is out of ground contact, the scientific data formats are collected by the Central Terminal Unit (CTU) and routed via the Remote Control and Interface Unit to the Data Storage Unit (DSU), to ensure their retention for subsequent transmission during the next scheduled tracking period.

Data is stored in blocks of 32 frames to maintain the scientific format structure as acquired. A temporary buffer in the RCIU is filled at one



Above: The Ulysses trajectory viewed from 15 degrees above the ecliptic plane. The blue segments show regions in which the heliographic latitude of the spacecraft exceeds 70 degrees. Dots are plotted along the Ulysses trajectory at 100 day intervals.

of the three available data storage rates (512, 256 or 128b/s). When a buffer is full, the RCIU starts the tape recorder and dumps the completed data block onto it at a higher speed (16kb/s). The recorder is then stopped until the next buffer is full.

To recover stored data, the RCIU uses the same start-stop technique and the temporary buffer is read out by the CTU at the necessary speed to accommodate the interleaving process to the commanded telemetry bit rate. The start-stop operation ensures an operational capability at different record and playback bit rates.

The 45MB capacity of each tape recorder is adequate to fulfil the requirement of continuous storage at 512b/s for 16 hours or 256b/s for 44 hours.

The Attitude and Orbit Control Subsystem (AOCS) comprises the redundant sun sensor, the Attitude and Orbit Control Electronics (AOCE), the Attitude Measurement Electronics (AME) and the Reaction-Control Equipment. In routine operations, attitude measurements are made by using X-beam and meridian slit sun sensors and the AOCS contains the necessary electronics for processing the Automatic Gain Control signal from the Telemetry, Tracking and Control subsystem to determine the spin-axis pointing error. The sun sensor output signals are selected and conditioned in the AOCS electronics and routed to the data handling subsystem, where the spin reference pulse and spin segment clock are derived. These signals and the sun sensor data are then processed within the AOCS to determine the spin rate and solar aspect angle for the closed-loop onboard control, failure detection and recovery system.

Thrusters for attitude, spin and trajectory correction manoeuvres are activated either by telecommand or automatically within the AOCS electronics. The Reaction Control Equipment is a hydrazine system with catalytic decomposition thrusters. It consists of a main tank with two redundant branches, each controlled by a corresponding latch valve and monitored by pressure transducers. Two clusters of four thrusters are located on the +X and -X axis, providing complete redundancy for up/down, spin and spin-axis adjustment.

Ulysses' power subsystem uses a 28 volt main bus and a combination of centralised and decentralised supplies to other subsystems. The AOCS and data handling subsystems receive their secondary voltages through converters, which are part of the power subsystem, whereas the remaining units and all experiments are supplied directly from the 28V bus, protected by latching or foldback current limiters.

The main bus is controlled by using a double linear shunt regulation system, operating the RTGs at a constant output voltage. This is achieved by varying the resistive loads.

The wire and axial boom electronic unit is used to control deployment of all three booms. However the radial boom is of a self deployable type, which is activated by firing pyrotechnic devices. The pyrotechnic electronic unit delivers firing pulses to release both the radial boom and the experiment sensor covers.

Ulysses was designed to be operated with intermittent ground station coverage and consequently there are long periods of time when the spacecraft is operating without the possibility of Control Centre intervention. Autonomous protection against failures is therefore essential. A further requirement for autonomous protection stems from the time delay in executing commands. In view of the large distances that Ulysses is travelling from Earth, transmission time may be up to 45 minutes in each direction.

Uses NASA's DSN

Tracking and data acquisition for the Ulysses mission is provided by NASA's Deep Space Network (DSN). The DSN has stations in California, Spain and Australia which are spaced 120° apart in longitude around the Earth. As the Earth rotates, a planetary spacecraft will always be in 'view' of one of the DSN stations.

During most of Ulysses' mission, the DSN is in contact with the spacecraft eight hours a day. The spacecraft records all of its engineering and scientific data during the 16 hours it is out of contact with the DSN and then during the eight hours of contact, it transmits the stored data from its onboard tape recorders.

SPYING ON THE SUN

The 30-metre antennas located at each of the DSN stations are used to transmit and receive data from Ulysses. To conserve antenna coverage during peak periods at the DSN, the ground controllers can use the large 70m dish antennas to communicate with the spacecraft. The use of the larger antennas permits a higher data rate from Ulysses. Data received from the spacecraft is transmitted to the Jet Propulsion Laboratory in Pasadena, California by a combination of land lines, satellites and ground microwave links.

Science payload

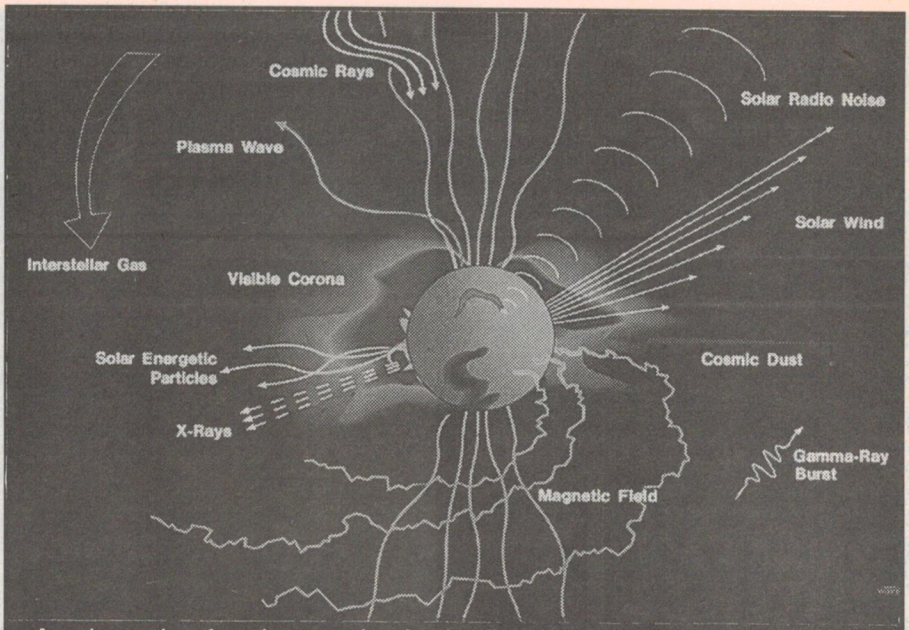
Ulysses' scientific payload consists of nine instruments, as well as the spacecraft's radio which is also being used to conduct two experiments. Two other scientific teams are also conducting interdisciplinary studies. The experiments concentrate on all aspects of solar science and are expected to increase our knowledge of the Sun by an enormous amount.

One familiar scientific instrument that is missing from Ulysses is a television or imaging camera, which was used to great effect in previous planetary missions such as Pioneer and Voyager. Because of Ulysses' proximity to the Sun, it would prove impossible to use a camera.

The Magnetic Fields experiment is measuring the strength and direction of the Sun's polar magnetic fields, about which little is known because they cannot be observed from Earth. These measurements will help identify the specific regions of the outer portion of the Sun's atmosphere (or 'corona') from which the solar wind originates.

Solar wind is a fully ionised gas which consists of electrons and the positively charged atoms (ions) from which the electrons have been removed. The Solar-Wind Plasma experiment is measuring the basic properties of these ions and electrons such as speed, temperature and density. The outlying solar wind is expected to be different from and possibly more uncomplicated than wind from near the Sun's equator. If this is correct, it will be easier to relate the observed solar-wind particles to conditions in the region of the Sun from which they originated.

The Solar-Wind Ion-Composition Spectrometer (SWICS) experiment is detecting heavy ions, which exist in the corona and constitute a minor but important constituent of the solar wind. By measuring the composition, temperature and degree of ionisation of this component, it should be possible to infer the temperature of the corona in the source region. This experiment will also detect solar-wind ions that have been accelerated or energised in interplanetary space.



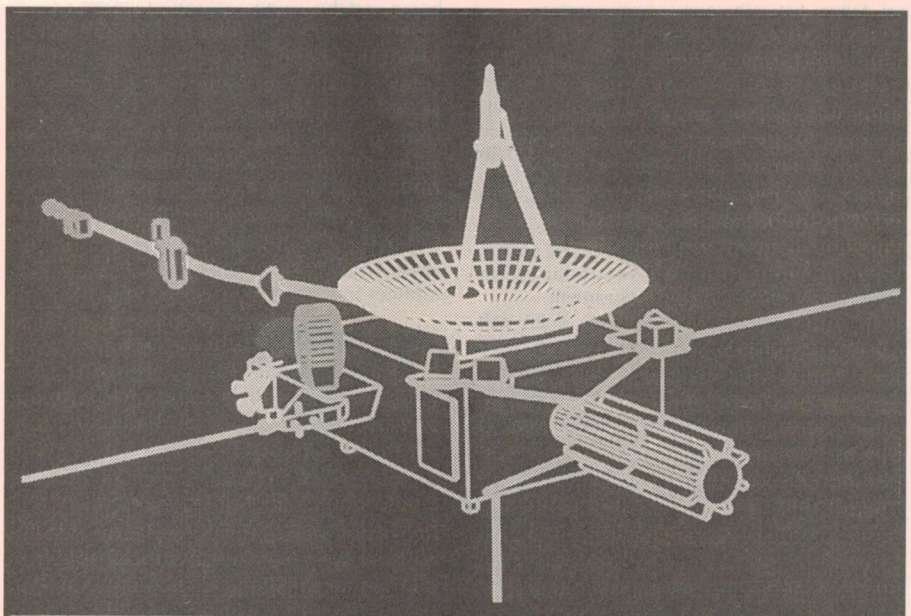
A schematic of various topics in the fields of solar, interplanetary and galactic science that will be investigated by Ulysses during the course of its missions.

The Heliospheric Instrument for Spectra, Composition and Anisotropy at Low Energies is an energetic particle detector that measures the composition and properties of low-energ[illegible] wind ions that have been accelerated to energies than those observed by the SW periment. Such particles can be energi the Sun as part of the process that produces solar flares. The investigations will also determine whether such particles exist at the Sun's polar regions. If so, the measurements can be used to study further their origin, storage in the corona and subsequent propagation into space.

The Energetic Particle Composition and Neutral Gas experiment is an array of charged-particle telescopes on Ulysses that are investigating medium-energy charged particles and determining their composition, relative abundances, energies and direction of travel. Charged particles in this energy range mark a transition between solar particles and cosmic-ray particles, which are accelerated elsewhere in the galaxy and travel massive distances to reach the solar system. A separate instrument detects neutral helium atoms entering the solar system from interstellar space and determines their speed, temperature, density and direction of arrival.

The Cosmic and Solar Particle Investigation covers even higher- energy cosmic rays, as well as detecting energetic solar and interplanetary particles. Cosmic rays which have been studied for several years near the solar equator are likely to have preferred access to the equatorial zone of the solar system by way of the Sun's polar regions. This experiment measures the properties of the cosmic rays before they are strongly altered by their interaction with the solar/interplanetary magnetic field. At present, the properties of cosmic rays at these energies are unknown as they exist only in interstellar space.

The Solar X-Rays and Cosmic Gamma Rays experiment is detecting X-rays that are emitted



An exploded view of the spacecraft in flight configuration. The radial boom carries two magnetometers, the solar x-ray and gamma-burst detectors and a search coil for magnetic wave detection. It's deployed to a length of 5.6m.

sporadically from the vicinity of solar active regions. Although these X-rays have been observed for many years above the Earth's atmosphere, the altitude in the solar atmosphere from where the radiation is emitted and its directivity (which would identify the source mechanism) is unknown.

As Ulysses travels between the solar poles, the sun cuts off or 'occults' radiation at low altitudes and affects how the intensity varies with direction to the source. Cosmic gamma-ray bursts were first detected 25 years ago, but their origin has remained a mystery. By accurately timing their arrival at Ulysses and Earth, their source location can be pinpointed precisely to see what astrophysical objects or bodies give rise to them.

The Unified Radio and Plasma-Wave Experiment uses two sets of deployable antennas to measure high-frequency radio waves that are emitted from active solar regions, as well as lower-frequency 'plasma' waves that are generated in the solar wind near the spacecraft. The radio-wave observations are being used to diagnose the space medium between the solar polar regions and Ulysses. Observations of the locally generated waves provide information about the internal workings of the polar wind, particularly the instabilities that transfer energy between the waves and their constituent particles.

By using the Cosmic Dust experiment, the speed and direction of small particles can be detected and their interplanetary trajectories can be deduced. Mass and charge of the dust particles can also be measured, so that competing effects on their motion of solar radiation, gravitation and solar-wind particles can be observed. The distribution of dust and its changing properties from the solar equator to the poles helps distinguish the contributions of the three main sources: asteroids, comets and interstellar dust.

The Coronal Sounding experiment uses signals transmitted simultaneously by Ulysses' radio at two frequencies, to infer properties of the Sun's corona along the path from the spacecraft to radio receivers back on Earth. From subtle shifts in the relative phase of these two signals, the density and directed velocity of coronal electrons can be inferred at the location where the radio waves pass closest to the Sun. Of particular interest to scientists are these properties of the corona in the Sun's polar regions, as the spacecraft ascends in latitude.

The Gravitational Wave experiment makes use of the spacecraft's radio transmitter for scientific purposes. According to Albert Einstein's theory of relativity, the motion of large masses in the universe — such as those associated with the formation of black holes — should cause the radiation of gravitational waves. Although these waves have yet to be detected, they could be observed by their effect on Ulysses, which is expected to undergo a slight perturbation that may be detectable as a shift in frequency of the spacecraft's radio signal.

Successful launch

At 7:47am (Florida time) on October 6th 1990, space shuttle *Discovery* was launched from Pad 39B at the Kennedy Space Centre. On board was the crew of STS 41 with Commander Dick Richards, pilot Bob Cabana with Mission Specialists Tom Akers, Bruce Melnick and Bill Shepherd.

Six hours into the flight, Tom Akers deployed Ulysses and its Inertial Upper Stage from *Discovery*'s payload bay. An hour later, Ulysses had reached a safe enough distance from the space shuttle to fire the motors of the IUS, placing it into a trajectory towards Jupiter.

As Ulysses had to leave the ecliptic plane, it had to cancel the Earth's motion and build up speed in a new direction. This was achieved with Ulysses reaching a speed of 41 kilometres per second, which made it the fastest interplanetary spacecraft ever launched.

Following a 16-month flight from Earth, Ulysses approached Jupiter in February 1992 at a speed of 16km/s on a carefully calculated route that took it north of the giant planet. The Ulysses science team used the Jovian encounter to make fresh studies of the ferocious battle between the planet's magnetism and the solar wind. Jupiter's gravity took charge, bending Ulysses' trajectory in a southward direction. The spacecraft was closest to the planet on 08 February 1992. By the time it escaped from Jupiter's influence, Ulysses was heading out of the ecliptic at a speed of 8km/s.

By September 1993, Ulysses was at 40° south and already absorbed in the fast solar wind that blows from the south coronal hole of the Sun. In March 1994, while at 55° south, Ulysses experienced the last of many shock waves due to solar outbursts.

Three months later, the spacecraft had reached 66.5° south. Although this was not a significant milestone in the flight, it was similar to a ship or aircraft passing the Antarctic Circle back on Earth. During July and August 1994, the latitude had increased by roughly a degree a week and by September, Ulysses had reached its furthest south solar latitude of 80.2°. Following that, the spacecraft returned rapidly to the Sun's equator, and was planned to cross it at 32km/s early in March 1995. Its orbit will then carry it to the north solar pole by mid year.

Although Ulysses' mission is scheduled to end in September 1995, technical studies have concluded that the spacecraft has enough power and thruster fuel to last for a further six years. If ESA can get continued participation by NASA in the project, the spacecraft will return to Jupiter by April 1998. Four years later in November 2002, Ulysses will arrive at the south solar pole, where it will be able to observe the Sun in a highly active phase — which is the opposite to its current quiet phase.

ESA in the past has achieved spectacular success in extending the lives of their spacecraft. The most stunning example of this was when they sent the Giotto spacecraft to Halley's Comet in 1986, then placed it into hibernation for six years until Giotto was able to encounter Comet Grigg-Skjellerup during 1992. Currently, the catchcry with ESA for Ulysses is 'Let's Do It Again'.

If the extended mission does take place, Ulysses will then have lived up to the promise of its ancient namesake and has proved that it is indeed a worthy contender in the search 'to follow after knowledge and excellence'.

In conclusion, the author wishes to thank Mary Hardin of the Jet Propulsion Laboratory and Jean-Pierre Provost of the European Space Agency for their assistance in the completion of this article. All photographs shown are by courtesy of ESA and NASA. ❖

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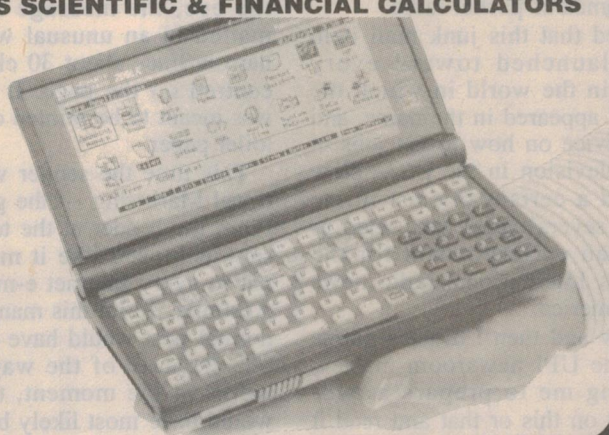

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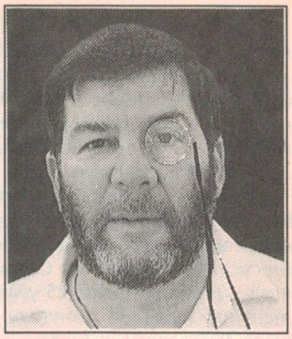
Moffat's Madhouse...

by TOM MOFFAT



E-mail, J-mail and gobbledygook

In last month's Moffat's Madhouse we discussed the matter of privacy and the right of free speech, or the lack thereof. And we just touched on the subject of the Internet, the Information Highway, and how governments could use it to regulate the thoughts of their citizens.

One privacy matter that is getting more and more attention in Australia nowadays is junk mail, and junk telephone calls — 'direct marketing' is the popular euphemism. This is a pretty touchy subject, and the last time I brought it up in Moffat's Madhouse it provoked some rather strong reactions from people whose business it is to sell you stuff you never knew you needed, until you got that unexpected letter or phone call.

I didn't have any qualms at all about expressing my personal distaste for these practices; after all, I didn't invite these mail or telephone visitors into my home. Therefore their presence is an invasion of my privacy. And that's what lots of other people are saying too.

It was only a matter of time, then, before I got my first junk e-mail (electronic mail) on the Internet. The item wasn't aimed directly at me; instead it turned up in a newsgroup devoted to packet radio, which I had been visiting regularly during the preparation of some articles about using TCP/IP on amateur packet radio.

It appeared that this junk mail item had been launched toward every newsgroup in the world in which the word 'radio' appeared in the name, and it offered advice on how to get jobs in radio and television in the USA. Now this sparked a certain interest in me since I had, several years ago, acted as an Australian correspondent for the United Press International radio news service in America.

Every now and then I'd get a phone call from the UPI newsroom in New York, asking me to prepare a two-minute story on this or that and read it back up the phone to them. This would then be broadcast nationally, sometimes world-wide, and then a nice little cheque in US$ would arrive in the mail. Not a lot, but occasional beer money...

This item on the Internet got me thinking. It would be nice to get something like that going again, so I took the bait and sent off an e-mail reply to the Internet address given. And a couple of days later, I was rewarded with a list of services I could subscribe to, for money.

The list began with some of the job titles on offer — disc jockey, weather presenter, talkback host — but unfortunately no 'foreign correspondent'. The company offered to send out lists of jobs available every week, via normal mail, fax, or e-mail on the Internet. These were not job placement offers or counselling, mind you — just lists, like classified ads. The cost for the e-mail version was US$155.00 for 50 weeks.

The scheme was obviously aimed at users within the USA. But, if someone in Australia wanted to try to crack it in radio or TV in the USA, this service might just work. Because, with the help of e-mail and the trusty fax machine, you can apply just as quickly as the locals. So this 'junk' mail wasn't really junk at all.

Another junk mail item was a little more personal; it ended up right in my own e-mail mailbox. In order to catch the eye, the message had been formatted in an unusual way, with very narrow lines about 30 characters wide, centred on the page. It looked like it was meant to be printed out on a roll of toilet paper.

This time the sender was Radio National Marketing — the good old ABC. From the header at the top of the message it looked like it must have gone out to every Internet e-mail mailbox in Australia. To hit this many users via the normal post would have cost a fortune, but, because of the way the Internet works at the moment, this mail drop would have most likely been absolutely free. This is important, as you shall see.

What the ABC was plugging was their prestigious Boyer Lectures, to be presented by Kerry Stokes, a media proprietor who includes in his stable the Golden West regional television network in Western Australia, the *Gold Coast Mail*, and the *Canberra Times*. Internet users were obviously targeted because of Mr Stokes' subject: 'Travelling down the Information Superhighway.'

He asks the questions: What should we be building? Who should own it? Is it necessary? Will there be a demand for it? Will it pay for itself? Are there other alternatives?

By the time you read this, the lectures will have been to air and Mr Stokes' thoughts will be common knowledge. But the interesting thing is, at this stage, that people are starting to ask these questions in the first place. Because the Information Highway has the potential to make someone very, very rich.

As it stands now the Information Highway, in the form of the Internet, isn't earning anything for anyone. There are commercial organisations providing *access* to the Internet for a price, but as for actual minute-by-minute usage, there is at present no mechanism for charging. So, if someone can find a way to charge for Internet usage, they can become our next media baron.

One way to abolish free Internet usage would be to abolish the Internet. Then it could be replaced by a commercially oriented user-pays system. Kerry Stokes warns that Telecom and Optus would be quite happy to step in and fill this role, and he calls for a 'reserved capacity' for the use of 'small and specialist service providers in accordance with general public need and interest principles'.

But that in itself implies that someone will be in control of the Information Highway in order to provide that 'reserve capacity', and users will be there only at the pleasure of that con-

trolling body — in other words, at any time the controller could pull the plug.

The Internet, by its very nature, is uncontrollable. Some refer to it as anarchy. Some refer to it as an electronic sewer. But its very uncontrollability is the Internet's charm. At the moment ideas flow freely — newsgroups are like bellying up to the bar in a pub and discussing the affairs of the world with the other tosspots. But where the pub is a room, newsgroups are the world. I know I may be criticised for saying it, but it would be a real shame for someone to be in a position to impose 'etiquette' upon the Internet. Its present free spirit would be squashed flat.

Still on the subject of the exchange of ideas, have you noticed that talk and writing within the English language seems to be sinking into a morass of turgid mud? Communication nowadays is sometimes like a secret code, undecipherable to those not in the know.

In magazines such as *Electronics Australia*, we are always accused of talking jargon. You know, using words and phrases that are incomprehensible to anyone other than those already familiar with electronics. When looking in from the outside, one suspects that jargon is used mostly to befuddle outsiders who might otherwise try to claim that they're one of us.

However I don't think this rag is really too jargon-ridden. We do use words specific to electronics — volts and amps and resistors and capacitors — but they're not totally unheard of in general usage. In fact, the spelling checker I always use when writing this stuff doesn't complain in the least about the words mentioned above; they seem to have become an integral part of the English language as she is generally spoke.

But, in some publications about technology, such as the more prestigious computer magazines — well! I guess I'm going to have to admit that more than once I've waded through some technobabble-ridden article and I've come out the other end not even having a clue what it was about. Seriously! And I'll bet you have too...

Technical writing may have its excuses, because there are some things that are so new that a fresh, unknown word is necessary to describe them. But other times, obfuscation is used mostly to prove that the writer is smarter than the reader. For instance: in many Australian high schools, including the ones my kids went to, students are told that the bigger the words they use in their essays, the better the marks they will get. So students know it's to their advantage to use words like 'obfuscation' instead of simple bewilderment.

Excellence in obfuscation produces a form of writing known as 'academic English'. Here many of the words are *real* blockbusters, and a thorough knowledge of this language form is often a prerequisite for a good university job: Take for instance this ad in the *Weekend Australian*: 'Candidates ... who lack a university degree, are required to attend a one-month tutorial program in mathematics and technical and ACADEMIC ENGLISH...'

But it doesn't stop at universities. How about this selection from a memorandum circulated by Amnesty International: 'The Background Paper contains details of the investigation which informed the proposals, and analysis of that research, as well as detailed argument for the recommendations.' Wouldn't it have been simpler to say something like 'this report explains why we decided to do it this way'?

What you are reading here is the result of nearly a year's observation of the English language and its occasional degeneration into unmitigated gobbledygook. I've been keeping a little computer file called GOBBLE.TXT, into which I have been inserting some of my more interesting finds. Now it's time to reveal all...

Take these quotations from the Public Service:

'the time line for these responses is a bit tight...'

'I am envisaging that after your responses I will be able to write a resolution...'

'entrenched resource problems... which must have an impact on the shape of support strategies...'

The methods for monitoring and evaluation are output-centred and generic in nature.'

'The current resource model ... is a very staff-centric model.'

'These human resource management issues should be articulated...'

Yes, Minister. Do you recognise this style? It's Sir Humphrey Appleby, risen like a phoenix from the deepest bowels of the repository of television re-runs. Except this is Real Life. People really TALK this way. Why? Because they were taught to, I suppose.

Hold on! Here comes some more: From a Hobart City Council Alderman: 'we will be pedestrianizing that part of the development'. I think he means they are going to put in some footpaths.

Or the lady from the insurance company: 'we are going to diaritize that'. Translation: enter it in the appointment book. And from an SBS documentary about violence against women, some more new-speak: 'Pathologize, Psycologize, Femocracy.'

Had enough yet? No? Good, because here comes some more, such as this word uttered by Justice Minister Duncan Kerr: 'Progressivity'(??) Sorry, translation not available.

How about one from ABC television: 'Weaponize'. Apparently that's what you do when you turn reactor fuel into nukes.

How about one more: 'Objectivication'. This gem from the ABC's 'Attitude' program refers to what happens when women are subjected to the attentions of male persons who may be deficient in politically correctness.

And now for the grand finale. This one is like the end of a fireworks display, when they let off a big starburst and everyone says "Oooh! Aaah!". It comes from a publication by the Australian Association of Social Workers:

'Operationalization: The time fraction required for the supervision of each supervisee should be calculated (including time for preparation and evaluation) and the other responsibilities of the supervisor should be adjusted accordingly. The lines of authority between supervisor and supervisee should be clearly stated.'

Notice those last four words — 'should be clearly stated'? I suspect we have here a case of 'physician, heal thyself'. Oooh! Aaah! ❖

HI-FI
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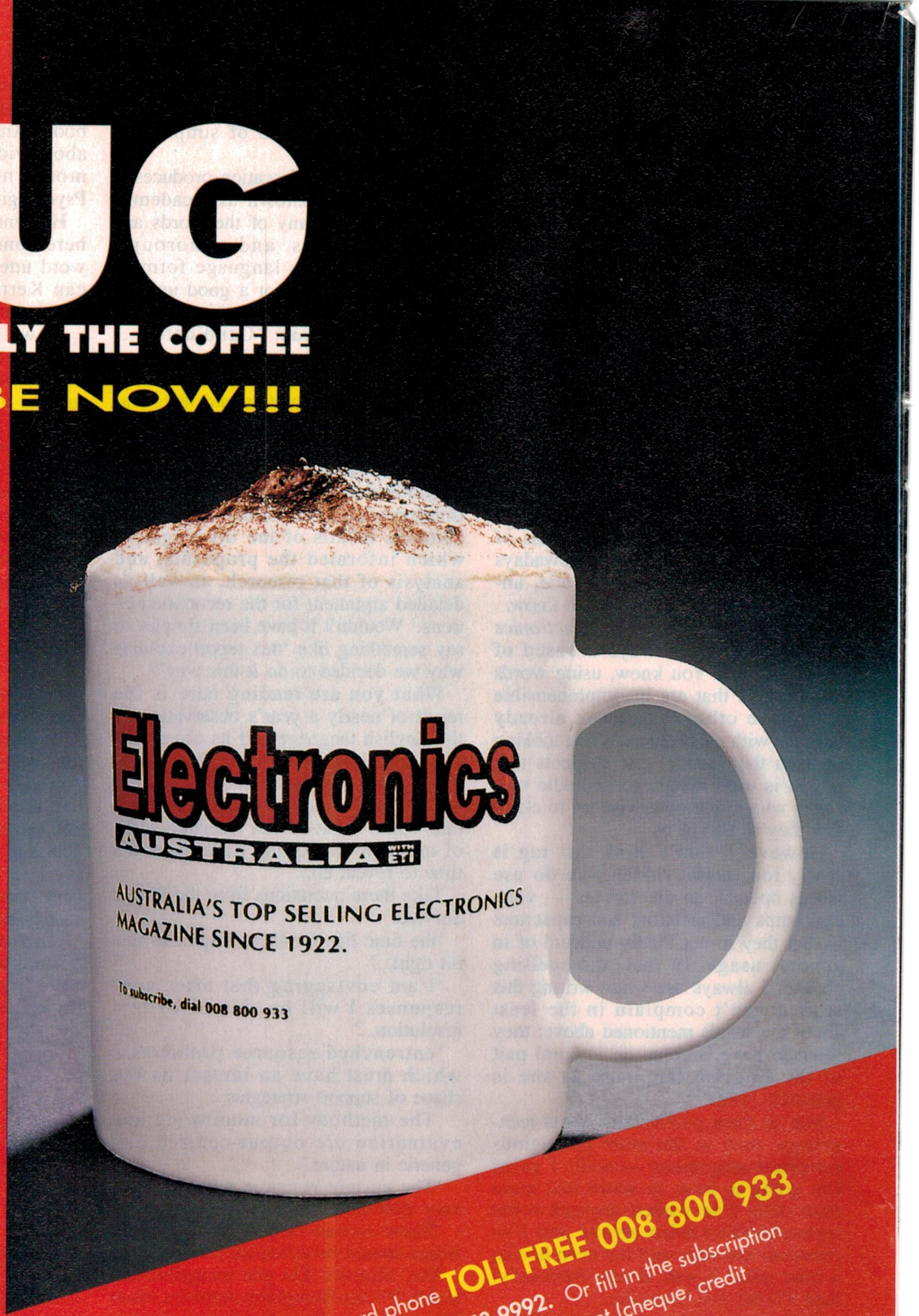

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SHORTWAVE LISTENING

with Arthur Cushen, MBE

Vanuatu installs all new equipment

Radio Vanuatu in Port Vila has recently been heard using new equipment for both medium and shortwave transmissions, and broadcasting from a new site near the capital.

Radio Vanuatu is installing two new 10kW transmitters for shortwave, to replace the ones on 3945 and 7250kHz. These will be located at a new site at Enton Lagoon, a swamp area. This is the site also of the new 2kW mediumwave transmitter for Port Vila on 1125kHz, with a power of 2kW. A new mediumwave transmitter is to be installed on Santo, also with a power of 2kW.

My first reception of the then New Hebrides was of the Armed Forces Station, operated on 1045kHz with the call WVUR, on the 25th March 1945. The verification letter stated that due to wartime restrictions it was impossible to give specific technical information concerning the station, which was on Espirito Santo.

New Hebrides, now Vanuatu was heard in the late 1950s and in 1971 the station received a gift from the Australian Government of a 2kW shortwave transmitter which operated YJB4 on 3960 and YJB7 on 7260kHz. A mediumwave transmitter was donated by New Caledonia in late 1971, with a power of 1kW. This was first heard on 1422, and later on 1125kHz.

In 1976 a breakaway group on Espirito Santo formed a station known as Radio Venerama, which was heard on two frequencies — 3577 and 3522kHz. A verification letter dated 8th June 1976, confirmed reception. Broadcasts orginated from Tanafo, Santo and the letter was signed by Mr Jimmy Molly Stevens.

Later transmission was severely jammed, and the jamming of the signal was noted in New Zealand during our evenings. The interference originated from a British group set up in Port Vila to block the reception of the Espirito Santo station in the New Hebrides. Subsequently, the station was captured and Jimmy Molly Stevens was jailed. In more recent times, he was released and he lived back on Santo until his death.

The broadcasts are on mediumwave. As well as 1125kHz from Port Vila, the Espirito Santo transmitter is on 1179kHz — both with 2kW. Frequencies have been registered for future expansion of the service and these include 2485, 3330, 4950 and 6100 as well as the present frequencies of 3945 and 7250kHz. This is according to Chris Rogers, reporting in DXer's Calling.

Higher power

Many countries have been upgrading their equipment. Here is a summary of those which have been observed over the past weeks:

CROATIA: Zagreb has installed a further 100kW transmitter and is broadcasting 1230 - 1600 on 13,640kHz; 1600 - 2000 on 11,630 and from 2000 - 1230UTC on 7370kHz.

INDIA: All India Radio has installed two further 50kW transmitters at their regional stations at Jaypur and Imphal. Jaypur is on the new frequency of 3295kHz and Imphal is using 4775. Both signals have been heard at 1530UTC when they carry the English AIR news from Delhi.

PARAGUAY: AWR is installing two 50kW AM and FM transmitters and is being sponsored by a single donor, a Brazilian doctor, at a cost of $1.6m. The station will be known as AWR Paraguay.

TURKEY: Ankara is installing five 500kW transmitters and is looking for suggested frequencies and transmission times for Europe and North America. At present, Turkey is received in English 0300 - 0400 on 9445kHz; 2000 - 2100 on 9400; 2200 - 2300 on 11,710kHz to Europe, to the Middle East 2200 - 2300 on 7185; and to South West Asia 1230 - 1300 on 9675kHz.

ZIMBABWE: Harare has been heard with new 100kW transmitters and has returned to shortwave on 3305kHz. (Programme 2) and 3395kHz (Programme 3), in English. The station has been heard in North America opening at 0300, also closing at 2200 on 3305 and 4836kHz, and should be better during our winter.

New signal from Zambia

Signals from Zambia have been difficult to receive in the South Pacific, but the opening of a new high powered Gospel broadcaster should make reception relatively easy. Using the slogan 'Christian Voice' and broadcasting entirely in English, the transmissions are on 6065kHz using a power of 100kW and with a broadband non-directional antenna.

The transmitter and antenna are identical to another new station. The Zambia transmitter is broadcasting 1400 - 2030UTC.

The programmes are mainly transcribed in the United Kingdom and there has been no format established as the station is more or less in a test period. It is located on an area outside the capital, Lusaka. Plans have been announced to test on two further frequecies, 4968 and 7250kHz. ❖

AROUND THE WORLD

MONGOLIA: Radio Ulam Bator broadcasts in English to Australia 0910 - 0940 on 7290, 12,000kHz; to Asia 1445 - 1515 on 7290, 12,000kHz; and to Europe 1930 - 2000UTC on 13,650 and 17,900kHz. These are daily transmissions and there are several other broadcasts not on a daily basis.

RUSSIA: The Voice of Russia World Service has been heard with English news 1600 - 1615UTC, then Focus on Asia and the Pacific operates on 4975kHz. The transmitter is located at Tajikistan.

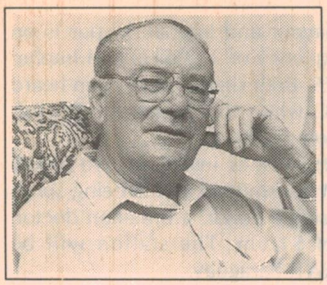
RWANDA: Deutsche Welle, Kigali is reported back on the air in English 2100 - 2150UTC on 15,270kHz, but this frequency is blocked by HJCB in our area. The transmitters were not broadcasting for several weeks during the fighting in Rwanda.

SOUTH AFRICA: Trans World Radio is using a Channel Africa transmitter of 500kW at their high powered site of SABC at Bolmendale and is operating to West Africa 0604 - 0700UTC on 1,720kHz, 1900 - 2100 on 9510kHz; to East Africa from 0332 - 0428 on 9500kHz and 1804 - 1900 on 9525kHz. Further broadcasts are planned to West Africa 2100 - 2200UTC. This is the 10th transmitting site operated by TWR.

USA: Prophecy Countdown Inc, the new owners of WCSN, Scotts Corner, Maine (500kW), plans to make a call change to WVHA. The address of the station is: PO Box 1884, Mt Dora, Florida 32757, USA.

Another call change is KAIJ, Dallas, Texas which was formerly KCBI. The broadcasts are heard at 0900 on 5810kHz with a gospel programme and also using 13,815kHz around 2000UTC. ❖

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.



When I Think Back...

by Neville Williams

Readers have their say - 2: What are 'Collectables'? — Archie Caswell & Singapore

I'm still working through a stack of unanswered mail, a by-product of being laid up for several weeks in hospital. The next letter to hand raises the question of what constitutes 'collectable' items, for readers interested in relics — either electrical or electronic. The short answer, I guess, is 'Whatever takes your fancy'; but there are other, more practical considerations!

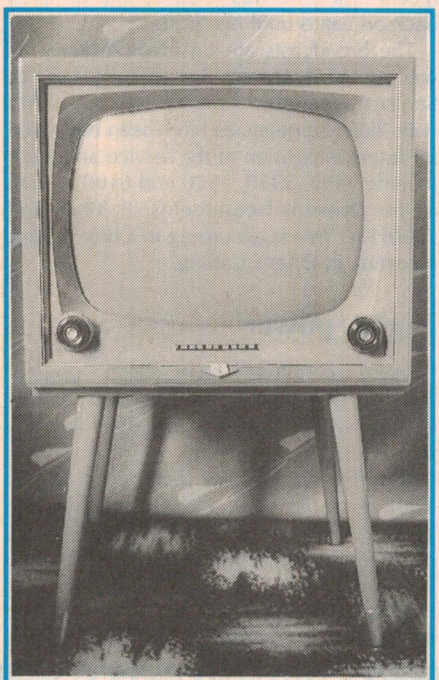
Alan Barrow of Aspendale, Vic, says that he has been a regular reader of *EA* for about 15 years, and finds the various vintage radio articles 'fascinating'. Unlike many of his peers, however, Alan is not an old-timer; he has certainly dabbled in repairs and restoration but confesses that 'valves have largely remained a mystery to me!'

My impression of the average reader/collector is that they face the reverse problem: being older, they can cope with valve technology and traditional wiring, but solid-state devices on PC boards turn them off — even if mainly because of failing eyesight!

I gather that, as a technically interested friend, Alan Barrow had been invited to help 'clean out the shed' of an older acquaintance who had recently died. In it, he says, was stored left-overs from just about every whatnot that the deceased had ever owned: 'washing machines, cars, boats, trucks, radios, furniture, etc'. In a quandary, his relatives had decided that what could not be distributed usefully would be have to consigned to the tip!

The item that most interested Alan was an elderly black and white TV set, supposedly purchased in 1956 to take advantage of the Olympic Games. Clearly branded 'Kelvinator', Serial No. K00430, it obliged with normal sound and a somewhat unstable picture — a horizontal hold problem — when dusted off and switched on.

Suitably encouraged, Alan rang the Kelvinator number, to be told: "You've got the wrong place, mate. We've never made televisions 'ere... Nar, mate; fridges and air conditioners only... we don't service televisions 'ere!"



Prompted by the recent articles on Admiral B&W TV receivers, and offered this obsolete Kelvinator model gratis, Alan Barrow asks whether B&W TV sets would qualify as 'collectable' electronics memorabilia.

Despite the put-off, and as evidenced by the photographs, the disowned receiver certainly exists, in remarkably good shape, and is clearly branded, complete with serial number. Major components like the picture tube and loudspeakers are clearly Australian-made. So why would a spokesman for Kelvinator deny all knowledge of it, and would this affect its worth as a 'collectable' from the first generation of Australian-made TV sets?

Forty years ago...

In other circumstances, I would probably have attempted to ferret out the background to the current Kelvinator logo. But it may be sufficient at the moment to refer back to the Fred Thom story in the October '92 issue (p.31). There, Fred tells of the stresses which faced the Australian radio industry in the postwar/pre-TV era, and the instability that followed the intervention of big-name American white goods manufacturers.

As Fred explains, Tasma lost its corporate identity in the schmozzle but kept right on producing TV receivers, as also did Thom Electronics, but never under their own name. As indicated elsewhere, Stromberg Carlson also ran into marketing problems doing the same thing.

At this remote point in time, present-day staff in what I gather is now a 'whitegoods' outlet for Email could well be totally unaware that their employer dabbled in 17" and/or 21" B&W TV sets 40 years ago. I imagine that management would long since have discarded redundant paperwork, circuit diagrams and spare parts. Even an old-time B&W TV servicemen could be hard put to it to recall that the Kelvinator, as pictured, used a chassis from 'Strommies' or whoever — identifiable from a dog-eared service manual.

Does that discount the worth of Alan Barrow's ancient B&W receiver? Not if he can recount its background and

demonstrate that it still works — 40-odd years after it was christened 'Kelvinator'.

But would it be worth considering as a 'collectable' relic? That would depend on those 'other practical considerations' — notably Alan's living quarters, and whether they're one room, a flat, an apartment or a spacious cottage...

If Alan or any other electronics history buff chooses to major on historic clippings, documents and pictures, he/she might conceivably store them in a filing cabinet or two.

Supplement these with a wall cupboard, and they could accommodate a collection of smallish technical whatnots: Morse keys, a brace of microphones, crystal detectors, valves, primitive receivers, horn loudspeakers and so on. Given a bit more room for a shelf, and there'd be a place to stow two or three restored pre-war mantel receivers, still able to fill the room with acceptable music.

Who owns this house?

But introduce a floor model radio or two, and the living space could become visibly cluttered, particularly for someone who does not share the interest: "Your hobby has become an obsession... a so-and-so eyesore!"

Alan Barrow might reasonably argue that his modest Kelvinator TV is no more bulky than a floor model radio — or a Stromberg-Carlson TV or an Admiral eqivalent that featured so prominently in a recent issue. In short, Alan, it's over to you; its a matter of what takes your fancy — and what you can accommodate!

Perhaps, at this point, I should add that extra care would also be necessary when involved with B&W TV receivers, to minimise the risk of an accident. As with a mains powered radio receiver, there will be an internal connection to the mains and a DC high tension supply of around 250 - 300V.

As well, there will be an EHT supply to the picture tube of 15kV or more. Because of its limited current rating, this is not directly dangerous — but a 'bite' could promote an impulsive body movement that could itself cause injury or wreck something.

The picture tube can be distinctly vulnerable, particularly types in early models requiring the provision of a front safety glass — as in the case of the Kelvinator in question.

Kingsley stereogram?

In a letter to hand from Jim Davis, he says that he has recently gained possession of a stereogram branded 'Kingsley', which is equipped with twin loudspeakers and fold-out 'Garrard' 3-speed auto record player. It would appear to be a 1955/6 model, using valves, but too recent to have been produced by the original Kingsley organisation.

It raises the question whether another manufacturer gained legal rights to the name, or decided to use it without formal permission...

A blow to the glass envelope could cause it to 'implode', creating a shower of glass particles. Care is needed, when handling an exposed tube, to protect one's eyes with industrial goggles or, at the very least, spectacles with generous plastic lenses.

Last but not least, you would need to study the how and why of TV circuitry. Fortunately, valve-based B&W receivers have a lot more in common with old-time radios than modern colour sets, but take time out to read before you fiddle!

Right now, B&W TV receivers have little or no commercial value, but if you consider them as logical canditates for restoration and display, drop me a line and we'll spread the word to other interested readers.

Unrestricted passion

Mind you, not everyone has to curb their passion for historical whatnots to match their living quarters — which takes me back to a letter from Jim Davis of Latrobe, Tasmania, referred to in the last article. While Jim provided useful information therein about Howard Love and Kingsley Radio, it was merely incidental to details about an extensive personal collection of electronic memorabilia that has certainly not been limited by either personal means or living space. Let me explain:

At age 81, Jim has reaped the rewards of a successful business career in the motor trade — aside from wartime industrial committments — centred in the Latrobe area of Tasmania. Then, in amateur radio lingo (VK7OW) he 'went QRT' from business (retired) in 1973, to concentrate on the collection and restoration of antique radios, phonographs and such like.

While his interest has been spread widely across evolving technology, his first love would appear to have been cinema equipment, evidenced by the fact that his family home was neither a flat nor a cottage but 'a large Spanish type hacienda' incorporating a complete purpose-built theatrette.

In-home 'flicks'

Measuring 11 squares, the theatrette had an acoustically designed ceiling, sound drapes, several rows of antique theatre seats, motorised curtains and screen capable of displaying a Cinemascope image 25ft wide! The acoustics were said, by Jim, to have been 'superb'.

Jim adds he had ended up with six fully restored 35mm projection machines in the projection room — a 1918 Hahn-Goertz hand cranked, and a huge 1927 Western Electric 'sync sound' system. Adaptable for sound on disc, it had been the equipment which had showed the first ever 'talkie' in VK7 (ham double-talk for Tasmania)!

It was reputedly complete with a rack and panel amplifier and accompanying WE loudspeakers — a multi-cellular HF unit, 17A mid-range pressure loaded exponential horn (12ft sound column with 5ft mouth); and below all this, two 15" LF units.

Also on hand was a USA 'Bogan' cinema amplifier with five-stage equaliser. ("I used to spend hours just listening to this system playing good quality 78rpm discs...")

Keeping this system company, Jim had two Raycophone J3 optical sound projectors of around 1939/40 vintage. He had replaced the original PE cells with

From a Kingsley Radio brochure for 1938. The central white line is the division between the front leaves, which open outwards to reveal the contents. (From Jim Davis' papers).

photodiodes, and says the frequency response was excellent.

The remaining machine was a 1926 silent projector, a Kalee No.7. Jim Davis said that he had taken out — and still holds — a current cinema projectionist's licence... "For the hell of it!"

Not only did the in-house cinema offer an appropriate setting for reclaimed movie memorabilia, but it provided space to display other equipment such as historic radio receivers around the walls. These ranged from antique wireless receivers dating from 1914 to a half-dozen or so more modern general coverage receivers, including a pristine Kingsley AR7 with coil boxes. Also on display were 15-odd transceivers related to Jim's amateur activities — plus, in contrast, mechanical phonographs dating back to 1897!

Prominent among the smaller items was a collection of broadcast quality microphones, ranging from a 1926 Philips PCJ carbon, double button and transverse current carbon types to a classical RCA ribbon 'velocity' model.

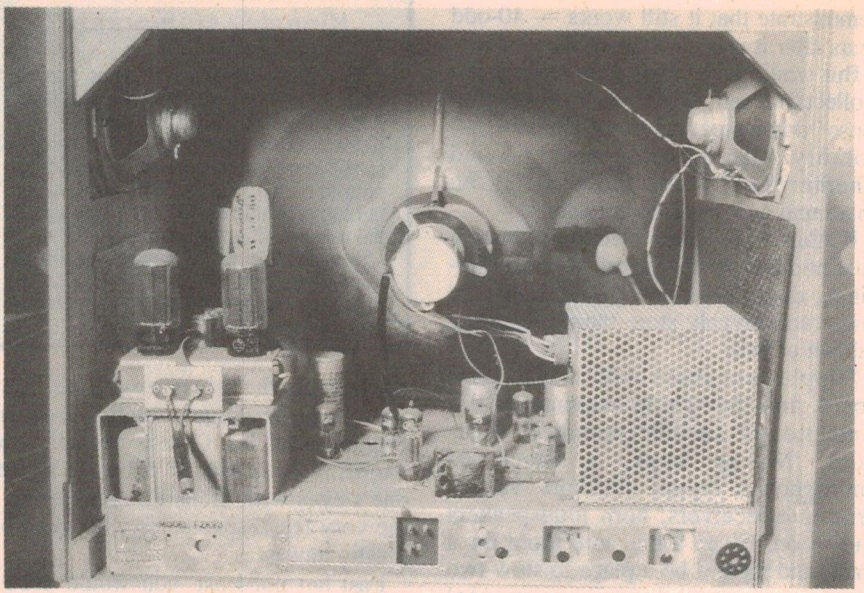
History on tape

Jim Davis says that, over the years, as an amateur and a collector of 'wireless' memorabilia, he had made the acquaintance of interesting pioneers from overseas. One such was the late Roy C. Corderman (W7ZW), who was the original engineer for the memorable US broadcaster KDKA on 1020kHz. He had helped Dr Frank Conrad of Westinghouse build KDKA's first modest transmitter.

Years ago, they had supplied Jim with a tape recording detailing the early KDKA. He was able to return the compliment when a flood in the station's basement destroyed all their records, and the contents of Jim's tape became a surviving remnant of the station's history.

Another interesting contact was 'Spenny' (H.C.) Spencer of Warwickshire, UK, made on the 14MHz amateur band. In his late '80s, and operating under the callsign G6NA, Spenny said he had been a junior tech during the initial experimental transmissions from 2MT Writtle, later 2LO London.

They had recorded some of the tests on a WW1 Edison cylinder Dictaphone. Again, Jim Davis was the recipient of a taped copy. It carries the voices of a technical discussion between a couple of engineers, followed by a test transmission featuring Dame Nellie Melba singing 'Home, Sweet Home'. This dates back to late 1921 and 1922.



Conventional, accessible and still functioning, this 'orphan' Kelvinator TV should be a practical starting point for a novice collector. Alan Barrow would need to identify the make and model number of the chassis to obtain a circuit. Can anyone help?

Elsewhere on the tape 'Spenny' tells how he was a design engineer for Pye TV (UK) and involved in the production of their first TV transmitter — as ultimately installed in Alexandra Palace. Thereafter, with the help of two others, he went on to design the first production TV receiver.

Only 12 receivers were built but, by sheer good fortune, one of them ended up in Jim Davis' collection. It was apparently brought out from London by a doctor in the late 1930's and finished up in Hobart. It came to the attention of a technician at the Royal Hobart Hospital, who managed to secure it on Jim's behalf. As far as 'Spenny' Spencer could ascertain, the only other example in existence is in the London Technological Museum.

In fact, says Jim, he has collected quite lot of radio history recorded on Edison cylinders through to 33-1/3 rpm discs — with the necessary gear on which to play them. One such cylinder carries the actual voice of Florence Nightingale, with a message to 'My Dear Old Friends of Balaclava'.

Important activity, but...

As a record of one collector's activities, Jim Davis' letters emphasise how absorbing and fulfilling the collection of electronics memorabilia can be, particularly for someone who has passed the halfway mark in their anticipated life span. At a time when evolving technology discounts their training and background, it is reassuring to keep alive the associations of the past. Also to be able to share the lifestyle, the methods and the skills of other days with those who have a sense of history...

To tune a radio station, select a colour TV program or listen to a hifi presentation, the rising generation needs only to read a label and press a button — a barren exercise indeed. It is all too easy. The most effective way to appreciate where we are at, technically, is to contemplate whence we have come!

To emphasise the latter point, I could do no better than quote from another letter, to hand from Michael J. Wellen-Charteris of Bombaderry in NSW. Michael expresses appreciation of historical articles and says that, for convenience he has produced a separate photostat file of 'When I Think Back' and Peter Lankshear's 'Vintage Radio'. He continues:

I must be caught in a time warp, as most of the modern gear holds no joy for me and I love restoring radios from a time way before my birth in 1963.

Articles on the early boys in the game should be compulsory reading for modern students, as the advances we take for granted did not just happen overnight. It was through people we glimpse in your columns that we are where we are today!

Pardon me if I seem to have strayed from the original theme, but not really. Sufficient to say that if you have a hankering to collect B&W TV receivers or any other technical memorabilia or information, Jim Davis' letters emphasise

the scope open to anyone with the time, means and opportunity. But Jim's letters end on a quite different — and 'practical' note.

Five years ago, Jim and his 'XYL' (wife, in amateur parlance) contemplated their Spanish Hacienda, their domestic cinema/display and its social involvements, and agreed that it had outgrown the capabilities of an 80-plus years old couple. So they built a more compact home, with a small 'museum' to house the smaller items and shared the bulky projection equipment between the local Senior Citizens Club and the Devonport City Council — the latter for a projected working museum. I gather that Jim & Co are still involved in presenting film shows to the Senior Citizens, using the trusty old Raycophones, but somebody else now provides the auditorium and the seating, and cleans up when the show is over.

To the Alan Barrows of this world, the message is clear: Collecting memorabilia can be a rewarding and long-term hobby, but it is important to:

- Plan ahead so that the scope of your activity will not over-tax your likely resources; and
- Envisage to whom your potentially valuable collection may pass when you can no longer cope with it, lest it simply ends up 'on the tip'!

'RAFF' Radio

For a complete change of subject, I am indebted to Jack Griffiths (VK2BJH) of Kempsey NSW. Jack says that he dates back to the *Wireless Weekly* days and aplogises for his typing: "I'm getting a bit old and fuddy in the head these days!"

You put yourself down, Jack. Non-professional 'hunt and peck' typists commonly make a few keying errors, but there is nothing fuddy or duddy about the way you express yourself.

Jack says that the '50 and 25 years ago' page in the April 1994 issue stirred some memories of RAAF radio - pronounced RAFF RADIO — which was established during WW2 at the RAAF Northern Command Headquarters, Norcom, at Milne Bay, PNG:

Somwhere in the past, I read that your late Editor, John Moyle, was among those who established this station on the broadcast band, for the entertainment of local troops and others on ships in the vicinity.

The station was moved to Madang — with NORCOM — in 1945 and that's where my invovlvement began. So little has been written about the station that the following may be of interest.

I joined it in 1945, just after the cessation of hostilities, as the only technician on the staff of about seven or eight. All the others nevertheless had had previous experience with some aspect of broadcasting.

When I arrived, I found a room at the front of a thatched roofed building, lined with caneite. A door led to the studio which was reasonably large, with an announcer's desk. Real 16- inch broadcast transcription turntables had replaced the ordinary 12-inch turntables of the original station.

Also evident was an AWA mixing unit and behind the announcer's back, a row of five Kingsley AR7 receivers. One of these served simply as the station monitor, with aerial and earth terminals shorted together.

News, sport & shows

The others were tuned to various short-wave stations in Australia. A regular news service was taken from Radio Australia, and on Saturday afternoons we had just about a complete sporting coverage from stations in the main capital cities.

'Air conditioning' was simple but effective. An electric motor of about a half-horsepower blew air through ducting directly down on the announcer's head. The motor was switched by a relay operated by the microphone switch, which interrupted the blast of air while the announcer was speaking!

Just off the front room of the building was the transmitter room, which would have delighted amateur enthusiasts of the time. Everything seemed to have been salvaged from something else. Even the knobs on the PA tuning bore Japanese inscriptions.

The rig was built in a rack which had obviously come from an AR21 transmitter, except that the sides were missing. The transmitter itself comprised an electron-coupled oscillator using a 6V6 valve, set nominally on 1180kHz.

I say nominally, because the tuning coil was hand wound on a Marquis brand ribbed plug-in former, common at the time. There was no shielding.

The buffer/driver stage was a well known 807, which fed a pair of 813 pentodes on the top shelf and wired in parallel, calling for a power input of about 300 watts. Their combined RF output was fed to a Pi coupler, thence to a wire through the roof and strung between two convenient palm trees giving a span of 30 metres or so.

The station operated 6am-8am, 12noon-2pm and 5pm-10pm, with an extension to 12pm on Saturday nights. I recall that records and transcriptions of some radio shows were supplied gratis by certain Australian radio stations.

My involvement ceased when I received news of my posting home for discharge on Christmas eve. In effect, I just walked away and I don't know what happened. Others would have been posted home in the same way, and all I can guess is that the whole thing would have fallen apart and been scrapped.

Thanks for your letter, Jack. I'm not sure whether or not John Moyle had a hand in sponsoring the station you mention, but it would be characteristic of his interests. He compered a music broadcast in the early days on behalf of the Sydney Recorded Music Society and, as an amateur, would have encouraged RAAF personnel to build the kind of transmitter set up in PNG. ❖

Mumps proved lucky!

Writing from Arawatta in Victoria, L.C. (Lester) Wyatt says he was most interested in the recent articles mentioning Arch Caswell and Brian Breillat. He had enlisted for the RAAF radar training course about the same time as they had done, with Arch Caswell taking a supplementary course at Radiophysics (Sydney University) and with Brian and himself attending the PMG Research Labs in Melbourne.

They had all headed off for Singapore about the same time, but he (Lester Wyatt) was lucky — he caught the mumps en route! On arrival at Singapore, he was separated from his unit and sent off to a military hospital for isolation and treatment.

It was about that time that the Japanese intensified their aerial attacks, and Lester found himself shunted from one hospital to the next and still further isolated from his unit. There was much speculation about surrender, followed by the actual event a few days later — around February 15, 1942.

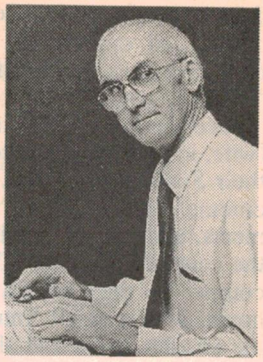
In the circumstances, Lester linked up with a group of other convalescent patients and decided that, rather than be POW's, it would be better to look for a boat and a way off the Island — before the occupying force could close off possible escape routes.

Lester's daily diary (I have a copy, WNW) indicates that what followed was no picnic but, one way and another, he finally made it to Colombo and thence back to Australia. He duly reported to RAAF Richmond, NSW, was transferred to Rathmines, and finally reposted to RAAF Radio Station 29 at Port Moresby, PNG.

To be struck down by mumps where, at one stage, he could neither eat nor walk may seem a strange idea of 'luck'. But if it hadn't been for the mumps, he would have ended up in the same POW situation as Archie Caswell and Brian Breillat who, in retrospect, would have had only a 30-40% chance of ever returning home.

FORUM

Conducted by Jim Rowe



Changing our nominal mains voltage, and should you use a CD player on a plane?

Let's have a complete change of scene this month, and look at a couple of topics we haven't discussed before. One is the question of whether Australia should change its nominal power mains voltage; the other whether our airlines are reasonable in banning their passengers from using portable CD players during flights...

It's probably about time we gave ourselves a break from arguments about things like qualifications for technicians, and looked at something different. In fact as I mentioned last month, there's a topic we haven't looked at before, but which really does deserve some thought and discussion: whether Australia should change its nominal power mains voltage.

This is a topic which is currently occupying the deliberations of various standards groups, yet it doesn't seem to have attracted much attention elsewhere. Which is a little strange, because if a decision to change the nominal voltage *does* occur, it'll probably have ramifications for most of us, at least in the long term...

Anyway, let's take a quick look at what it's all about, so you can give it some thought and decide if you want to discuss it further.

As you're no doubt aware, just about all countries around the world distribute power in AC form, generally in three-phase high voltage form to minimise losses. It's then stepped down in each area by transformers to somewhere in the range 100-450V, for use by the end users.

The actual voltages used for this final 'retail' delivery have varied quite considerably around the world, with single-phase voltages between around 80V and 250V, and three-phase voltages from about 190V to 450V between phases. In Australia we've been standardised for some time on a nominal 240V for single-phase use and 415V for three-phase, with Western Australia changing to this standard from 254V/450V about 12 years ago.

By the way, I'm using the term 'nominal' to describe these voltages because the voltages always vary within a given tolerance range due to transformer regulation, wiring voltage drops and so on. For example in Australia the basic tolerance range at present is apparently +/- 6%, with a further -4% allowed for wiring voltage drops.

So your nominal 240V power point may actually deliver anything between 226V and 254V with no load, and could drop as low as 214V under load. Similarly the voltage fed to each phase of a three-phase water heater or motor can vary anywhere between 440V and 369V.

Obviously makers of equipment intended to run from the mains are supposed to allow for this possible voltage variation, in designing their equipment. And many — perhaps most — of them do; that's why it's quite often possible to run equipment marked for a slightly different nominal mains voltage, without having to make any changes to it. Although we've all probably all heard of cases where equipment marked '230V' becomes very hot and fails in short order, when plugged into a nominal 240V (perhaps because the actual voltage happens to be up near 254V, in that area).

Not many standards

Although there's all kinds of weird and wonderful voltages still used in some of the developing countries (just as there were in countries like Australia, earlier this century), there's nowadays only a few nominal figures used by the main developed countries. North America and Japan use a nominal 115V/230V/400V system, while most of Europe has standardised on a nominal 230V/400V system.

Now until a couple of years ago, our own standard of a nominal 240V/415V was shared with the UK and a few other ex-Commonwealth countries. But in March 1993 the British Government announced that it would be changing to the nominal 230V/400V used by the rest of Europe, leaving Australia as the world's only major developed market with the 240V/415V standard.

Not surprisingly this has given our standards people a new topic for discussion, and there have inevitably been calls for Australia to change to the lower nominal voltage figures — one suspects for the sake of uniformity, as much as anything. But there've also been a few voices urging caution, and drawing attention to the possible problems.

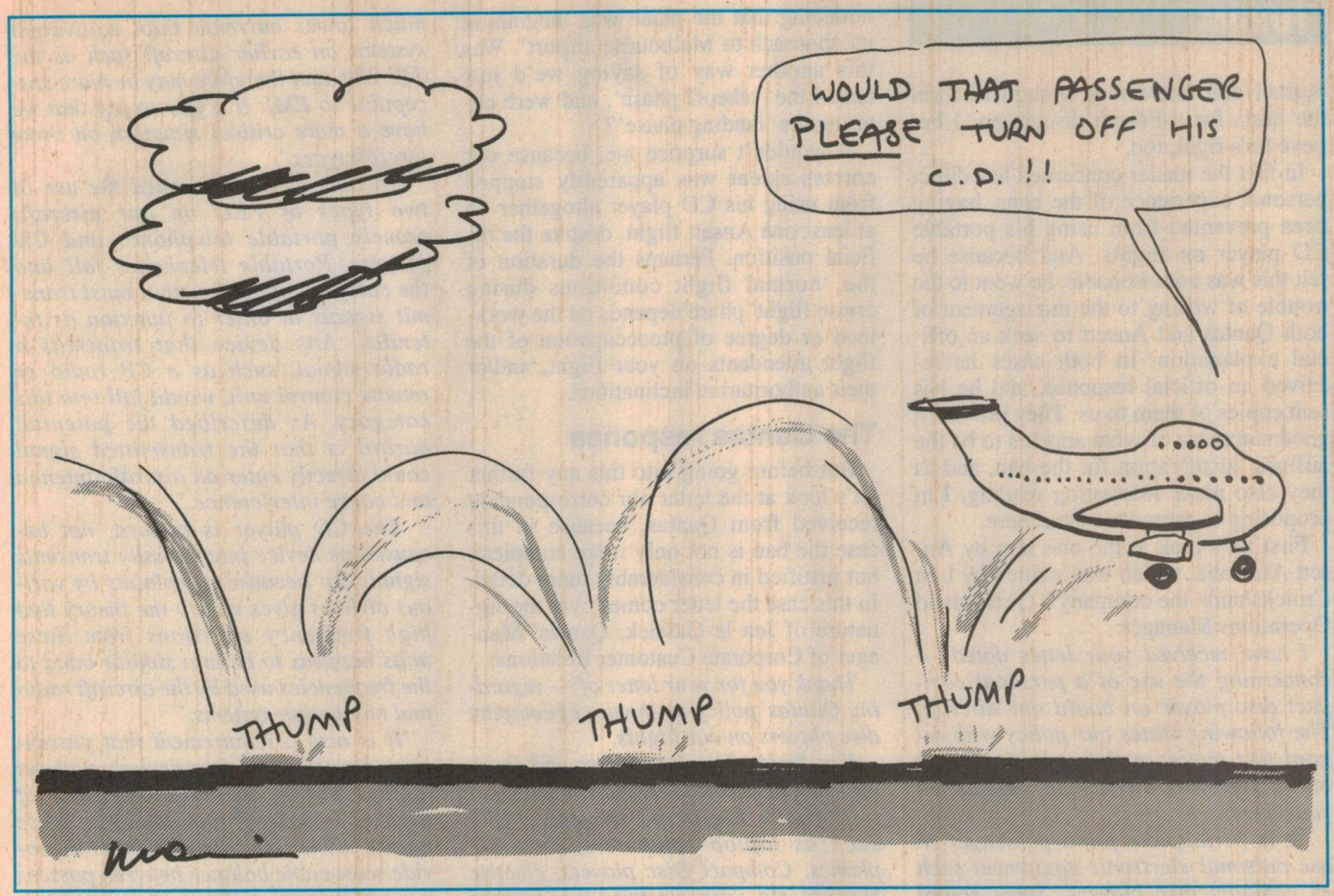
So that's the background. But what are the basic arguments for and against changing our nominal voltage?

Well, one argument in favour of changing is that it would bring us into line with a lot of other developed countries, and reduce the number of different voltages which manufacturers have to take into account when they design their equipment. This would in turn tend to result in small, but possibly significant drop in the price of some equipment.

There's also the argument that to a certain extent, we're also only talking about a change to our *nominal* supply voltage — which doesn't necessarily mean a change in *actual* mains voltage, in any particular place.

Does that sound crazy? It's not really as contradictory as it sounds; becuase of the allowed tolerance range in terms of transformer regulation and wiring voltage drop, you can change the nominal voltage figures by a certain amount without changing the *actual* voltages at all...

For example when Western Australia changed from a nominal 254V/450V down to the standard 240V/415V, many areas didn't change their actual voltages at all because their *delivered* or *utilisation* voltages were still within the acceptable tolerance range for a nominal 240V/415V system. They just tended to be up towards the upper tolerance limit, that's all! The



only areas which had to be cranked down were those where the delivered voltage was already near the upper limit for a 254V/450V system, so that they fell outside the new tolerance range.

Similarly many countries in Europe had a nominal 220V/380V, and when they changed up to the nominal 230V/400V standard there were a lot of areas where the actual voltages delivered were within the new tolerance range, and didn't need to be changed. Much the same is happening in the UK, in their change *down* to a nominal 230V/400V.

So in Australia, we could probably change the nominal voltages in quite a few areas, without having to change the *actual* voltages at all. But it certainly wouldn't be this easy everywhere...

In Western Australia, for example, there would probably be a *lot* of areas where the actual voltage would have to be reduced — because while they were able to sneak into the tolerance range for a 240V/415V system, they're too high to do the same for a 230V/400V system.

One argument against changing Australia's nominal voltage, then, is that the *actual* voltages would need to be changed, in at least some areas. And this would involve quite significant expense for power authorities, for a start. Many step-down transformers would probably need to be replaced, quite apart from the labour of changing taps on those provided with them.

Then, in those areas where the voltages *did* have to be changed down to the appropriate new levels, there are potential problems and costs for the *users* of power as well.

For example many kinds of lamp are quite sensitive to voltage, and both the output and colour temperature of their light output tends to change quite significantly with only a few percent change in voltage. This could force changes to all kinds of equipment, in order to maintain its performance.

Some kinds of electric motor are also quite sensitive to voltage, and their output power/torque characteristics change quite significantly for only a few percent of voltage change. So quite a few factories might need to replace the motors driving critical equipment — and this could again be very expensive for the firms concerned.

Luckily a lot of electronic items wouldn't need expensive changes, either because they're already provided with a range of taps on the power transformer primary, or because they use switch-mode power supplies with their quite wide tolerance to input voltage variations. But inevitably *some* equipment would need to be either modified or replaced, and its owners wouldn't be too impressed.

As you can see, though, it's a tricky question — and one that is hard to answer in terms of a simple 'yes' or 'no'. On the whole it seems a good idea to change to the nominal 230V/400V, but there's no doubt that such a change would cause trouble and expense to quite a lot of people — especially in Western Australia.

But what do *you* think? I'm sure there are lots of ramifications I haven't mentioned in this quick intro, so if you're aware of them please write in and share them with the rest of us.

Dangerous CD players?

Now let's change the subject, and to another one we haven't looked at before: the question of why our domestic airlines ban the use of compact CD players by passengers on aircraft, either totally or at least during takeoffs and landings — and whether this is technically justifiable or not.

I've been prompted to tackle this one by some correspondence from a reader in Brisbane, who wishes to remain anonymous but thought it was both im-

portant and interesting enough to form the basis for a Forum discussion. I believe he's right, too.

In fact the reader concerned has direct personal experience of the bans, having been prevented from using his portable CD player on flights. And because he felt this was unreasonable, he went to the trouble of writing to the management of both Qantas and Ansett to seek an official explanation. In both cases he received an official response, and he has sent copies of them to us. They provide a good summary of what appears to be the airlines' justification for the ban, and as they also make interesting reading, I'm proposing to reproduce them here.

First let's look at the one sent by Ansett Australia, which was written by Len Cruickshank, the company's Queensland Operations Manager:

I have received your letter dated --- concerning the use of a personal compact disc player on board our aircraft. The following states our policy with regard this matter, and has been sent by our engineering division in response to your query.

'It is permissible for a passenger to use personal electronic equipment such as compact disc players. Some equipment such as portable telephones (i.e. designed to transmit) are prohibited.'

'The only limitation on the use of Compact Disc Players, notebook Personal Computers etc. is that they are not used during the take-off or landing phases of the flight to eliminate the possibility of interference with instrument landing equipment or other critical systems. We also reserve the right to request any passenger to turn off personal equipment at any time so that if the technical crew are observing erratic indications, then the possibility of such interference can be eliminated.'

We hope the above answers your questions. In short, you are able to operate your portable compact disc player under normal flight conditions during cruise flight. A copy of your letter has been forwarded to the Manager of our Flight Attendant Department for the matter to be addressed.

So that appears to be the Ansett position — a portable CD player *can* be used, but only 'under normal flight conditions during cruise flight', whatever *that* means exactly. I suspect that it's a rather flexible definition, as on flights from Sydney to Melbourne I've heard messages over the plane PA system when the plane was over Albury, announcing that the plane was 'beginning its approach to Melbourne airport'. Was this another way of saying we'd just ended the 'takeoff phase', and were entering the 'landing phase'?

It wouldn't surprise me, because our correspondent was apparently stopped from using his CD player altogether on at least one Ansett flight, despite the official position. Perhaps the duration of the 'normal flight conditions during cruise flight' phase depends on the workload or degree of preoccupation of the flight attendants on your flight, and/or their authoritarian inclinations.

The Qantas response

But before going into this any further let's look at the letter our correspondent received from Qantas, because in this case the ban is not only more complete, but justified in considerably more detail. In this case the letter comes over the signature of Jen le Gassick, Qantas' Manager of Corporate Customer Relations:

Thank you for your letter of --- regarding Qantas' policy on the use of compact disc players on our flights.

Ken Lewis, Head of Safety and Environment, has issued the following advice:

'Portable Electronic Devices (PED) such as laptop computers, portable phones, Compact Disc players, electric shavers etc., are electrically operated and therefore by nature emit Electromagnetic Interference (EMI). EMI is made up of transmitted voltages or currents that may adversely affect the operation of airborne electronic systems. This could occur either by the EMI entering via an aircraft antenna or by direct entry to the system through wiring or backplane connectors.'

'It should be noted that testing for susceptibility of the airborne systems to EMI is carried out by the aircraft and component manufacturer, however EMI exists in many and varied forms — there is no such thing as standard EMI. It is therefore difficult to guarantee protection in aircraft systems, especially with the proliferation of PEDs, all of which may have individual EMI signatures. The problem is compounded by the fact that PED manufacturers don't have to consider emission protection in their design to the standards required for aircraft use.'

'Modern aircraft such as the 747-400 are designed with an extensive suite of electronic control equipment. As these electronic packages advance in design they become smaller, with higher levels of integration in the circuitry (thousands of transistors on a single chip). This means that the circuits operate with much lower currents than equivalent systems on earlier aircraft such as the 747-200, and therefore may be more susceptible to EMI. It is fair to say that we have a more critical situation on these aircraft types.'

'To date we have banned the use of two types of PED on our aircraft, namely portable telephones and CD players. Portable telephones fall into the category of devices that must transmit signals in order to function as intended. Any device that transmits a radio signal, such as a CB radio or remote control unit, would fall into this category. As described the potential hazard is that the transmitted signal could directly enter an aircraft antenna and cause interference.'

'The CD player is banned, not because this device intentionally transmits signals but because complaints by various airlines gives rise to the theory that high frequency emissions from these units happens to be in a similar band to the frequencies used by the aircraft radio and navigation systems.'

'It is also a requirement that passengers do not use other devices such as laptops during the critical phases of flight, i.e., takeoff and landing. These measures were introduced in order to provide reasonable balance between passenger convenience and operational safety.'

'It should be noted that all similar devices installed permanently on the aircraft by the manufacturer or the airline operator must first comply with rigid testing for EMI as part of a certification process for the device. Design will incorporate sufficient measures such as shielding to ensure that EMI will not cause operational problems to other aircraft systems.'

'Next generation aircraft such as the Boeing 777 will require much greater efforts to ensure that EMI will not interfere with normal operation. The FAA is currently carrying out an extensive investigation on this issue, however in the meantime each Airline has to decide upon a set of standards for allowed use of PEDs consistent with the aircraft type and flight regime encountered. It may seem unfair to include some PEDs that have operated for many years on earlier aircraft without problems; however until we understand more about this subject it becomes a case of all bets being off.'

It would seem, then, that Qantas goes considerably further than Ansett, and bans the use of portable CD players altogether during flight — although 'other devices', including laptops, seem to be allowed at times other than takeoff and landing...

Excellent motives

Now I don't know about you, but I must confess that I found some of the reasoning in this second letter rather worrying. But before I try to explain why, I should stress that I have no doubt whatever that the people responsible for introducing these bans — in both Ansett and Qantas — have done so with the highest of motives. Clearly they are basing their decisions on the principle that the safety of the airlines' passengers and crew is paramount, and that any equipment whose operation is known or even suspected of providing a significant risk to that safety should therefore be banned from use. And no-one can really argue with that principle, of course.

So in principle, there's no problem. The only real questions are whether a device like a portable CD player *does* constitute a significant safety risk, and whether some of the justification given — especially in the Qantas letter — makes as much technical sense as it seems to be claiming.

Taking the second of these first, you can't argue with the claim that all portable electronic devices or 'PEDs' may emit EMI. But surely there's a big difference between those that are *designed* to transmit RF, like portable phones, CB transceivers and wireless remote controls, and those that *may* emit some radiation as a second-order side effect of their primary operation. The level of radiation is surely going to be a number of orders of magnitude lower, in the latter class of device, and the risk of interference significantly lower with it.

While one can't really argue against the ban on portable phones, CB transceivers or wireless remote controls (assuming anyone would want to use one of these on a plane, anyway), this explanation seems to become rather shaky when we come to devices like portable CD players.

For example, why draw the line at compact disc players, laptop computers and electric shavers? Just about everything else electronic is also in principle capable of emitting measurable EMI — including compact cassette players, pocket calculators, pocket dictation machines, pocket 'organisers', DAT players and so on. In fact I believe even living human bodies produce a tiny but still measurable EMI, so where *do* we draw the line — are *passengers* going to be banned on flights in the new generation of planes, as well?

Although the letter doesn't make it clear, presumably the reasoning behind the ban on CD players in particular is that they use *digital* circuitry. But of course they're by no means alone in this regard. Laptop and 'palmtop' computers, pocket calculators and organisers, DAT players and many of the latest pocket dictation machines are in the same category.

Now I don't have any figures, but frankly, because of their larger LCD displays, I'd expect laptop and other computers/calculators/organisers to emit *more* EMI than portable CD players. Wouldn't you?

It's this that makes me a bit skeptical of the logic behind the ban, when even Qantas allows things like laptops to be used during 'normal flight conditions during cruise flight' — but still bans the CD players altogether.

Now how about that next justification, the one about the electronic control equipment on the newer planes using a higher level of integration and lower current levels, and therefore being more susceptible to EMI? That's also an explanation that seems to raise more questions than it answers.

Certainly higher integration tends to bring with it lower power consumption, but at the same time it makes the equipment more compact, and therefore easier to shield. The lower power consumption also tends to make it easier to provide effective EMI filtering — so on the whole, I'd expect that this trend to more highly integrated equipment should make it *easier* to provide a higher level of EMI protection, not harder.

Don't forget too that the personal electronic devices we're considering as sources of EMI are also being more highly integrated all the time, as well. So *they're* not only becoming more compact, but also using less and less power into the bargain. So the level of EMI from things like personal CD players is almost certainly dropping, as these devices move to higher levels of integration — not just because of the lower power, but also because the wiring which is capable of radiation is shrinking as well, and is therefore less efficient at radiating energy...

That reference to CD players producing EMI which interferes with frequencies used by aircraft radio and navigation systems is also a bit of a worry, don't you think? I believe this comes from a scare in the USA, when it was thought that the use of CD players by passengers may have contributed to the crash of a couple of aircraft about two years ago. But my understanding is that although at the time of the crashes this seemed like a possibility, later testing with CD players in similar aircraft didn't provide any real evidence to support the theory.

Frankly my reaction to much of the justification given in the Qantas letter is that if the navigation and control systems used in the latest planes are indeed susceptible to the tiny level of interference which would be produced from some portable CD players, then the airlines are going to have *real* problems — and not just with CD players.

If the systems really *are* this susceptible to EMI, it suggests that they're going to be upset by radars, mobile and handheld transceivers, radio and TV station transmitters and a whole host of more powerful sources, whose signals will inevitably be intercepted by the plane's systems as they take off or land at our busy airports. And this in turn suggests that the aircraft systems concerned have simply not been provided with enough EMI shielding and filtering.

Of course if the airlines are just being super cautious about all of this, and not taking any chances until everything has been investigated thoroughly by the FAA, I guess we shouldn't be too critical. They're thinking about *our* safety, just as much as their own safety record, after all...

But what do *you* think? Is it fair to ban portable CD players altogether, while still allowing the use of laptop computers during cruising flight?

By the way, I've been trying to get some figures on portable CD player radiation levels, and also on those from laptop computers, but so far without any success. Perhaps if anyone has come across some further information on this, they'd send it in so we could all put things in better perspective. ❖

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READER INFO NO. 9

THE SERVICEMAN

The polarity of VW car batteries, and why service tips can be bad for you...

My column seems to have turned into a kind of mini-Forum this month, as a couple of readers have sent in some further information in response to the story I ran a few months ago about the VW with a reversed polarity battery. I've also heard a considered and thought-provoking argument against the publication and use of Servicing Tips lists, which I'm passing on here in an effort to defuse some of the controversy.

Of all the stories published in this column over the years, I can remember none that has attracted more reader interest than the one in the November column about the Volkswagen with the reversed polarity battery.

Almost as soon as the November edition hit the streets, people began writing or phoning about cars or engines or different battery charging problems. Most of the comments were just that — comments. But some were quite interesting stories, and will appear in these pages over the next few months. In the meantime, I'll give this month's column to the first couple of these tales to come to hand.

We open the account with comments from Ron Voller, of St Georges Basin in NSW. As you will see, Ron knows much more about car electrics than I do, so I'll reserve further comments until you have read his letter.

I have just bought the November EA and read your bit about the early model VW (presumably a Beetle) and its reversed battery polarity. Your summary of the chemical changes in the lead-acid battery during charging and discharging omits the vitally important role of the sulphuric acid contained in the electrolyte.

The active material in the positive plate of a charged cell is not lead sulphate, but lead peroxide. The negative plate, as you state, is spongy lead. The liquid (electrolyte) is dilute sulphiric acid, otherwise called hydrogen sulphate. (Neither plate of a charged cell contains active lead sulphate. Old and neglected battery plates often contain a passive, inert form of lead sulphate which can be ignored as it takes no part in the electrochemical reactions).

During discharge, the material in both positive and negative plates is converted to lead sulphate, the source of the sulphate being the sulphuric acid of the electrolyte. The hydrogen part of the acid combines with the oxygen derived from the lead peroxide to form water. Since there has been a removal of sulphuric acid from the electrolyte, its density (specific gravity or SG) is lowered and this is what is detected when we use a hydrometer to measure the state of charge.

During charging the process is reversed. The lead sulphate reverts to lead peroxide and lead in the respective plates, while the regenerated hydrogen sulphate — sulphuric acid — is returned to the electrolyte, whose SG rises accordingly.

A second point, regarding the reverse charging of a battery. A limited reverse charge is indeed possible. Was your informant absolutely sure of the correct initial polarity of the Veedub battery? In the early days of horseless carriages and six volt battery systems (the early Beetles were six-volters), it was not at all unusual to encounter new cars with batteries having the positive terminal earthed to chassis.

I can't remember if the VW, whose design by Herr Porsche dates back sixty years or so to the 1930's, was of the positive earth persuasion but I would certainly check any six-volt system for this possibility.

Earthing of the positive was aimed at reducing corrosion, at a car's many earth connections to chassis. In early vehicles these connections were exposed to road mud and particularly in cold climates, where salt is used for road deicing, there was sense in it. Any boat-trailer owner will know the nuisance value of such corrosion!

With the universal adoption of lower-current 12 volt systems and later the ousting of DC generators by the more reliable and cheaper alternators (made possible by solid state rectifiers), the negative earth configuration became a de-facto standard.

A VW aged forty or so could have had a wrongly-installed battery (they were not wonderfully accessible) and all manner of home-brew electrical modifications (including rewiring) might — and must — have been made over the passing years. Indeed, it seems likely that the electrical system had at some time been converted to 12 volts, as a six volt car cassette player would have been an unlikely beast for the customer to have found. Were they ever made for six volts??

Several questions arise. Who did the 6V to 12V conversion and what was the (now 12V) system's new polarity? Was the generator replaced or could it handle the higher voltage, perhaps with the addition of a resistor in its field circuits? I seem to recall the open circuit voltage of

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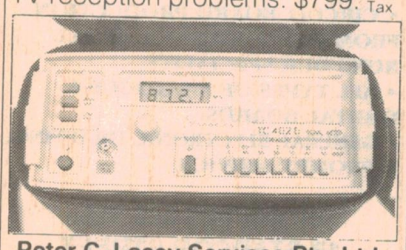

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READER INFO NO. 10

a six-volt car generator being at least 30-40 volts. A six-volt battery terminal open circuit on one occasion wreaked havoc on my 'points', when the engine continued to run for a time on the generator output voltage.

If only the Beetle's battery and voltage regulator were changed (apart of course from the current-consuming devices), the original generator polarity would have been retained. The conversion today would probably involve using an alternator.

Your comments on reversal of polarity of a generator are germane, and this could well have been the source of the trouble. It is less easy to figure how the voltage regulating system would react in such condition. Like you, I suspect it would be quite happy with the juice 'arsey-versey'.

I encountered such a reversal when erecting an ancient 5kW alternator, whose field would not excite. The nominal 40 volt exciting generator's shunt winding was killing its own (reversed) residual magnetism. The output drifted from a negative one down to zero, and stayed there. It was easy enough to take off the drive belt and use the exciter briefly as a motor with a car battery, in order to restore the original polarity. All was well thereafter.

When the auto-electrician eventually replaced the VW's battery, he would have done so with correct polarity; being an expert in the automotive field he would have been aware of any possible polarity peccadilloes of the ageless Beetle.

I mention the above as just another possibility which could have added to the confusion. It might also explain the flat battery and the erroneous connection of the jumper leads. Murphy, aided by many others, gets plenty of opportunities over the life of such cars.

My regards to EA and to all who sail in her.

Well, as you can see from Ron's opening remarks, I got it all arsey-versey (his words!) when I tried to explain what goes on inside a battery. That explanation was the best I could glean from my own vague memories and discussions with numerous so-called experts, including more than one 'auto-electrician'.

I can now remember learning the details, in chemistry classes at technical college some 50 years ago, but since it's not essential knowledge for day to day operations, it has become garbled over the years and parts of my memory have quite disappeared. Sorry to have misled you all, but I should point out that Mr Voller is the only correspondent out of many on this subject to have pointed out my error. So perhaps we all need this timely reminder.

The comments about the VW being a six volt system, and possibly positive earth, brings to mind my first car — a 1950's model Ford Prefect which, as I recall, had a six volt positive earth system. I remember fitting an AWA radio that had provision for positive or negative ground operation, but I can't ever recall seeing a cassette player with such a provision. Nor can I recall a six volt player, so Ron Voller's suggestion that the VW had been converted to 12V is probably the right one.

Whatever the answer, the original story from Peter Godfrey in the November issue has opened up an interesting and very popular subject. Thanks for your contribution, Ron.

Self-reversing generator?

Next, we hear from Peter Laughton of Albion Park in New South Wales. We first heard from Peter about a year ago, with a story about remote area power supplies. This time he writes about vehicle generators and alternators and things. It's very much a follow-on from the November story. Here's what he has to say:

I have just finished reading your latest column in EA and thought you might like my comments regarding the story about the VeeDub generator.

Quite a few years ago, I fitted a diesel motor to my truck. At the time I opted to not to remove the alternator from the old petrol motor, so I fitted a new Bosch generator on the diesel. This was relatively easy to do as a new bracket mounted it quite OK. The original regulator was removed and replaced with a type suitable for the generator. (I will explain later why I fitted a generator instead of an alternator.)

Upon firing up the motor for the first time, smoke billowed from the regulator and a loud squealing noise issued from within it. The motor was very hurriedly shut down! I removed the cover from the regulator, but couldn't see anything wrong. So the motor was started again, and this time there was an eruption of flame and smoke from one of the regulator contacts. Another hurried shutdown!

Further investigation revealed that it was the under-voltage cutout contacts that were burning up. I disconnected the regulator and started the motor again. When I checked the output from the generator (at this time only residual) it was about three volts — POSITIVE earth! Gotcha — it seemed that the generator was wrongly labelled and was really for a positive earthed vehicle.

To change polarity is easy. I reconnected the regulator, but disconnected its output (B+) terminal so that the battery wasn't connected to it. This was because it was going to fire up positive earth and the truck was negative earth. Then the motor was started again.

(Note: The old mechanical regulators and generators can be run open circuit without damage. Alternators can't, as their regulation circuit won't stop the buildup of voltage quickly enough to prevent the diodes being damaged. They are usually only rated at 100V or so.)

A short lead was then connected between the battery positive and the F (or field) terminal of the generator. A check with the meter indicated about 15 volts, negative earth. So far so good.

I reconnected the B+ terminal while the engine was still running and the ammeter indicated 20 odd amps charge. We left it running for a while, both to charge the battery and also to warm up the motor. After a good 30 minutes the current had dropped off to 5A and the voltage was hovering around 14V.

There is thermal compensation in most generator regulators, to put more charge back into the battery after a cold start than after it's warmed up. Hence the reason for the voltage drop from 15 to 14 volts.

All worked well for a week or two. Then one cold morning, after the truck had been sitting for a couple of days, the ammeter went crazy at start up and the squealing noise reappeared. You've probably guessed it! Yes, the polarity of the generator was again positve earth!

I flashed it up negative earth and resolved to investigate the problem as soon as time permitted. The problem happened several more times, usually on Monday morning after the truck had been sitting idle over the weekend.

I decided that to protect the regulator contacts from damage, a small switch was put on the dashboard. If the ammeter didn't read after start, just press the switch and everything was OK. The truck was very busy at this time so I had to wait for it to come back before I could continue my deeper investigation into the problem. This gave me time to formulate some theories as to what was wrong. The fireworks were caused by the voltage regulator sensing 12 volts output from the generator and closing the undervoltage contact to charge the battery, positive earth.

The current regulator then detected overcurrent and opened — dropping the voltage, thus opening the undervoltage

contacts and allowing the current regulator contacts to close, building up voltage, positive earth, etc. No wonder there were squeals and fireworks from the regulator! (A very POSITIVE example of positive feedback! — Ed.)

Eventually, I got time to work on the system. I removed the Bosch generator and replaced it with a Lucas C40 model. Obviously, the regulator needed replacing as well since the Lucas system regulates to earth, or common, and the Bosch type regulates to battery positive, or active. This completely solved the problem.

I carried out some tests on the old Bosch generator and it appeared that when it stood for a couple of days, the residual magnetism reversed itself. I dismantled the unit completely and found a very strongly magnetised section in one of the pole pieces. This was obviously strong enough to destroy the residual magnetism over a couple of days, so it effectively 'biased' the machine towards positive earth. If the truck had been a positive earth system, we would never have noticed it.

I've seen a bit of research into why alternators are better than generators, but I am yet to be convinced. Batteries definitely seem to last longer on a generator. Some battery manufacturers even give a longer (in my case four years) warranty, on a vehicle with a generator rather than an alternator.

The time constants within a generator circuit are around 150 times a second, whereas an alternator is around 300 times a second. These slower magnetic time constants may be the reason a generator seems to put a 'better' charge in a battery than an alternator.

True the alternator can charge 'quicker', but I suspect its only a 'surface charge', not deep into the plates. Maybe it doesn't matter with the thin plates of modern batteries anyway. Add air conditioning, a super car radio with multi-kW power amps etc., and the generator's 20-odd amps output wouldn't run a modern car.

Batteries in the truck with the generator last an average of eight to 10 years. Yet the same type of battery, on a similar truck in the fleet, with similar usage, only lasts three to four years.

So there it is. Changing the polarity of an automotive electrical system is not as straightforward as you might assume. Although I think that a generator 'biased' to an opposite polarity might be a bit too hard to accept...

As for Peter's assertion that a generator puts a 'better charge' into a battery, I'll stand aside on that one. To my way of thinking DC is just DC, and I can find no place in theory for time constants and surface charges. Then again, as I said after Ron Voller's item, I now know I know nothing about auto electrics, and will remain content to let others argue the toss about the subject.

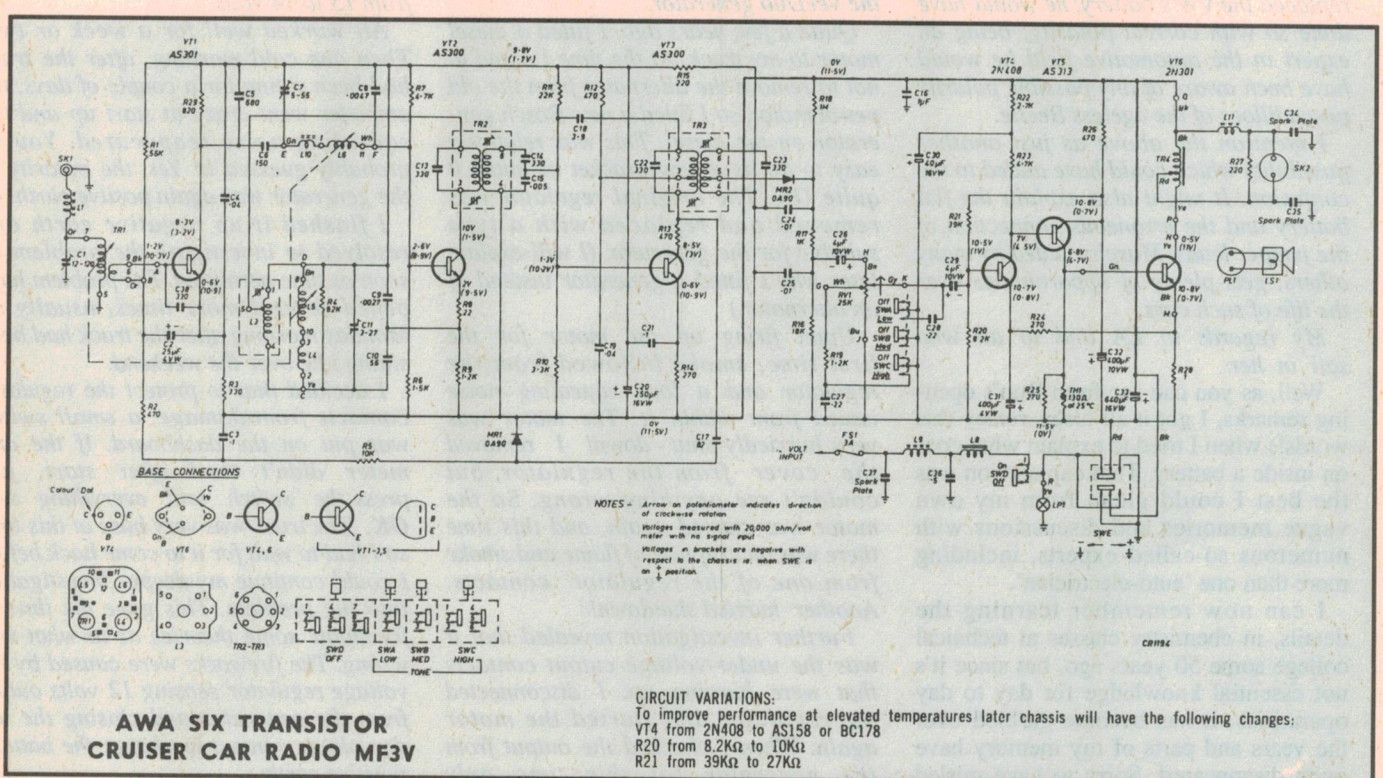
Thanks anyway, Peter. I've got another of your stories along similar lines which will be presented in a month or two.

Lists of faults

Now it's my turn to say a word or two, and to start I'm choosing a subject that has generated quite a bit of heat of late. It's on the subject of Electronic Faults Lists, which has been discussed at some length in this magazine and at various electronic forums around the country.

There are those who think it's right and proper to circulate service tips to all and sundry. Others, less altruistic, would only agree to circulate tips to those who are regular workers in the industry. Then there are those who think completely the other way — that making this material available to anyone outside his own workshop is giving an unwarranted advantage to commercial competitors.

All three of these attitudes are strongly held and vigorously defended, to the point where it has become almost dangerous to venture an opinion on the subject. Readers of this magazine will have seen the extremes of this argument



Wouldn't it be nice if radios were still as simple as this? A typical transistor car radio of the late 1950's and early 1960's, it came with a changeover switch (bottom right) to allow convenient matching to vehicles with either a positive or negative ground. Most other sets had a pair of fly leads which had to be swapped over and resoldered.

espoused in Forum and the Letters pages in recent months, but it was not until quite recently that I have heard a calculated and logical argument on either side.

The occasion was a recent convention of electronics technicians held in Albury, New South Wales. Some 80 techs from all over Australia gathered to hear and learn about the latest in domestic electronics technology. That in itself was interesting enough, but I found much more interesting the discussions that took place during refreshment breaks, lunch, and the Saturday evening Convention Dinner.

The service tips argument raged backwards and forwards for most of the three day convention, and for a time nobody was getting anywhere. The subject is so divisive that the only solution seemed to be for each of us to go his own way, and to ignore as far as possible the condemnation of those of opposite opinion. However, one person came up with a reasoned, well considered argument in favour of 'No Service Tips', which made me think that perhaps I was on the wrong side after all.

This chap was the manager of a medium sized service organisation. He is a former technician, now graduated to manager status and as such is able to stand back and look at what is going on with an educated but uncommitted eye.

He had noticed over the past year or so that his technicians were referring more and more frequently to the various service tips lists that he and they had subscribed to. In particular, his apprentices were tending to go straight to the tips lists, as soon as they had read the symptoms shown on the job cards. Even his more experienced people consulted the lists after only the most cursory attempt to diagnose the true problem.

At first, he was content to do nothing, on the assumption that their refusal to 'reinvent the wheel' was really saving time in his workshop. The argument was "...why spend time looking for a fault when it has already been found and published in a Faults List?"

Unfortunately, time has proved that to be the wrong attitude, since most of the faults were significantly different to the published ones, despite the fact that they had the same or similar symptoms. What was happening was that the technicians were going down the lists, changing part after part in the hope that one of them would be the right one.

Sometimes they would strike it lucky, but mostly they would have to go back to thinking about the problem and all the time and parts so far used were wasted. In fact, what was happening was that his technicians were becoming 'Tips Lists Junkies', unable to do anything without a 'fix' from the published lists.

For a time this manager was unwilling to alter the status quo, since he still held the opinion that it was saving time in his workshop. However, he eventually came to the conclusion that his people would have to start thinking for themselves again, since they were losing all feeling for the diagnostic side of their profession.

So one Monday morning, the Service Tips Directory had disappeared from the workshop computer and the printed lists were no longer in place on the shelves. Panic reigned for a while, but in time they got back to the old ways and throughput got back close to normal.

The manager had been afraid that production would drop off dramatically, but after the first day or so, he found that his people were doing within three to five percent of the work that had previously been accomplished.

As it turned out, his workers were not really lazy, but were just taking advantage of a facility that was available but not really essential. They were able to do almost as much work without the tips as they could with them. And since the tips were only encouraging laziness, the place is now better off without them.

A second and much more beneficial outcome of removing the tips lists is that his workshop now consumes only half the minor components that were being used in the past. The savings in lower usage, less frequent ordering and less stock handling more than compensates for the slightly lower productivity noticed since the tips lists disappeared.

So there! Whether you are for or against service tips, I think you will have to agree that that was a very reasoned argument against them.

This column has over the years provided a long list of service tips, and I'd hate to think that these were only encouraging laziness on the part of our readers. However, I have always striven to explain the logic behind each fault in the hope that readers would be able to use similar logic to think their way around similar faults in future. It would be tragic if these notes were used by readers as a 'no-thought' solution to their own problems.

Serial number dating

Now to finish off, here is a short follow-up to a recent item. Last month, I told the story of an NEC television set that appeared to be a late version of the particular model, yet had a very early serial number. The mods list I was working from suggested that this set was going to need a whole string of modifications, yet I found that they had all been done, putting that set among others with very much higher serial numbers.

Since then I have had a chance to talk with the Service Manager of one of the larger Japanese companies, and he has given me a logical explanation for the odd serial number.

It seems that these days, serial numbers are allotted to the bare boards as soon as they start on the production line. At various stages of production, tests might show a board to be faulty, so it is pulled off the line and sent to a rework station where it is brought up to standard for that particular stage.

In the meantime, production has proceeded and when this board goes back on the line, its serial number is out of order. Depending on how long it takes to correct the fault and how early in the line it had been located, a set could come off with an early serial, while all production around it carries much higher serial numbers.

This explanation does not apply to older sets, particularly those assembled in Australia. In those cases serial numbers were allotted at final assembly, or at least to completed chassis. So there you are. Serial numbers are a *guide* to a set's age, but not necessarily an infallible one.

This column is being written in late November and by rights I should wish you all a Merry Christmas and a Happy New Year. But since it won't appear in the magazine until at least Easter, perhaps I should just wish you the Season's Greetings and leave it to you to work out which season I'm talking about.

I'll be back next month. 'Til then, Bye! ❖

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DSE 'Discovery Series' Construction Project:

38-LED Roulette

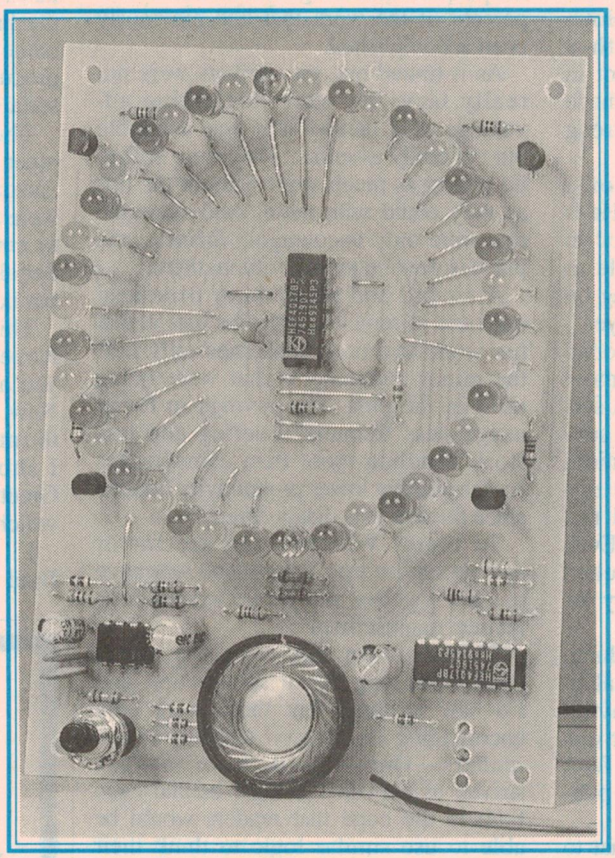
Latest release in the new Discovery Series of learning kits from Dick Smith Electronics is an electronic 'roulette wheel' which is an interesting application of basic digital counting circuitry — as well as providing a source of amusement. The complete kit for the project is available from DSE's stores (Cat. No. K-2804) for $29.95.

Roulette is one of the most alluring of casino games. The polished wooden table, the wheel with its red and black numbered pockets, chrome fittings and ivory ball clicking around with each spin, the bright green baize cloth with its red, black and gold lines and lettering, create a scene of subdued glamour.

With this project you can play the game as often as you like, without putting your money at risk. It has an electronic 'wheel' (using a circle of LEDs in a 'light chaser' configuration) and a betting table layout that are the same as those used in American casinos, where they have a wheel with two zeros (0 and 00) and 36 numbers. A set of game rules is provided with the DSE kit, which lists all the possible ways of placing bets and the odds that are paid on those bets. So when the unit is finished, you can get one or more friends over, turn the lights down, and let the casino atmosphere develop!

The 'ball' is set in motion by the press of a button, and a click is heard as each number is passed, as though a ball is actually rolling over the pockets. The ball slows down to a realistic 'cliffhanger' finish, before it finally stops.

The project operates from a single 9V battery (not included) and all of the components except the battery are mounted on a single printed circuit board.



Operation

The 'wheel' is made up of a circle of 38 LEDs which represent the numbers zero (0), double zero (00), and 1-36 as shown on the label provided. Red LED's have been used for numbers that would have red pockets on a normal roulette wheel, green LED's for black pockets and orange LED's for the two zero pockets. The betting table layout has been provided foolscap sized, which should be suitable for several players, but it could be enlarged by means of a photocopier if required.

The game is operated by a single push-button which is pressed briefly to start the ball rolling. The LEDs come on one at a time in clockwise sequence around the circle to simulate the ball rolling around the wheel, and a single click is generated by the small speaker as each LED comes on to simulate the ball rolling across the edges of the pockets. The ball begins its rotation at about 260rpm and then slows down — quickly at first, and then at a lower rate with the ball slowly clicking over the last few numbers until it stops. It takes about 18 seconds from the time the button is released to when the ball comes to rest.

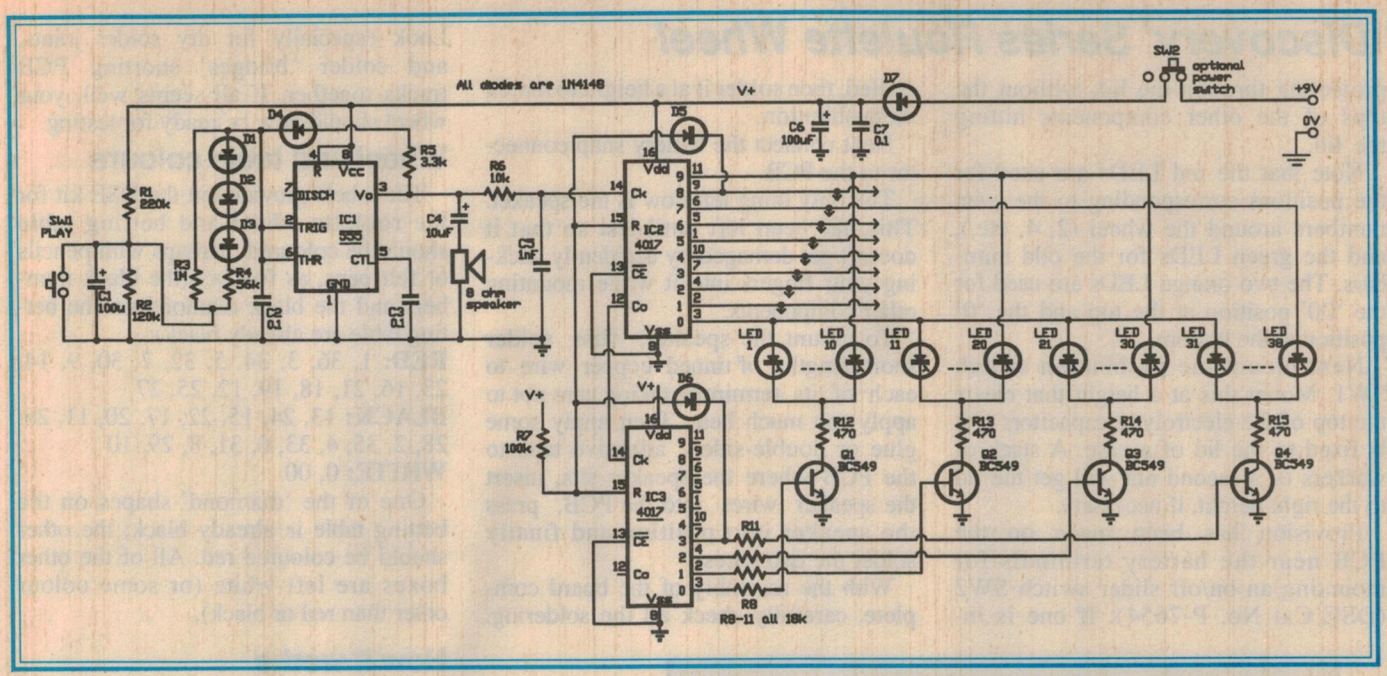
The number that the ball comes to rest at depends on the position that the ball is in when the button is released. Because of the high speed that the ball starts at, it is not possible to release the button when the ball reaches a particular number, and so the outcome is effectively a random one.

Construction

Construction of the game is fairly simple, as all the components except the battery are mounted on one printed circuit board (PCB) measuring 122 x 91.5mm.

To place the components, refer to the overlay diagram which shows how the components and wire links actually appear on the PCB. The wire links are represented by the straight lines without any labels, and the components are labelled — for example, C2 for capacitor 2. Next look for the component in the parts list which will give you a description of the component. For example, C2 is a ceramic capacitor with the value 0.1uF, which may be labelled 100n or 0.1u or 104, and has a voltage rating of 50V.

Begin construction by installing the links on the PCB. A length of tinned copper wire is provided in the DSE kit for this purpose. To install the links, don't cut the wire to length first; just feed the end of the long wire loosely through the two holes with the end of the wire projecting a short distance from the track side of one of the holes. Solder the short end first and then pull the slack through



Although the circuit is basically a 555 clock oscillator (IC1) driving a counter formed by IC2 and IC3, it includes enhancements to give the clock oscillator a 'gradual slow down' characteristic, and also a matrixing scheme to drive a total of 38 LEDs from the outputs of the two 4017 counter chips.

the unsoldered hole with a pair of pliers, taking care not to break the wire. Then solder the other end and cut it off, before repeating the process with the next link.

Now install the resistors R1 - 15 on the PCB. Look at the overlay diagram to find the part number, then look down the parts list to find the value required. The parts list shows the colour code that will be on the resistor.

The last band of the colour code (the tolerance value) is the one that is furthest from the others. Resistors can be mounted in either direction, but it is good practice to mount them with their colour codes all in the same direction for ease of reading the values.

Next mount the diodes D1-7. These are polarised and must be mounted in the correct way, with the stripe on the very end of the diode corresponding to the striped end on the overlay diagram.

Next mount the integrated circuits IC1-3.

CAUTION: IC's 2 and 3 are CMOS types which are sensitive to static electricity. Note the following precautions:

- Do not remove them from their protective foam until you are ready to install them.
- Avoid touching the pins with your fingers.
- Make sure that your soldering iron is properly earthed.
- Solder the power and earth pins to the board first.

The IC's have a notch at one end, which goes at the end where the notch is shown on the overlay diagram.

Next mount the transistors Q1-4. Position them so that the flat side is facing the direction shown on the overlay. Do not press them down hard onto the board as this spreads the leads too far and can damage the transistors inside.

Next mount the electrolytic capacitors C1, C4 and C6. Note that these are polarised and can be damaged if connected the wrong way around. The outside of the capacitor case is normally marked with a stripe and a negative sign (-) on one side near one of the leads, the other lead being positive (+). The overlay shows where the positive lead goes.

Now mount the remaining capacitors C2, C3, C5 and C7, which are all ceramic types. These can be mounted either way around.

Next mount the 38 LEDs. These have to be mounted with the cathode outwards. The cathode is the lead next to the small flat surface on the bottom edge of the LED, which is identified on the overlay with a 'k'. The recommended height for mounting the LEDs is 12mm (between the top of the PCB and the bottom of the LED). This height allows the PCB to be mounted in a case with the LEDs and the PLAY switch

PARTS LIST

Resistors

(0.25W 1% metal film unless otherwise specified)

		4-band 1%	5-band 1%
R1	220k	Red Red Yel Brn	Red Red Blk Org Brn
R2	120k	Brn Red Yel Brn	Brn Red Blk Org Brn
R3	1M	Brn Blk Grn Brn	Brn Blk Blk Yel Brn
R4	56k	Grn Blu Org Brn	Grn Blu Blk Red Brn
R5	3.3k	Org Org Red Brn	Org Org Blk Brn Brn
R6	10k	Brn Blk Org Brn	Brn Blk Blk Red Brn
R7	100k	Brn Blk Yel Brn	Brn Blk Blk Org Brn
R8-11	18k	Brn Gry Org Brn	Brn Gry Blk Red Brn
R12-15	470	Yel Vio Brn Brn	Yel Vio Blk Blk Brn

Capacitors

C1,6	100uF 16VW RB electrolytic
C2,3,7	0.1uF 50V ceramic (100n, 104)
C4	10uF 16VW RB electrolytic
C5	1nF 50V ceramic (.001, 1000p or 102)

Semiconductors

D1-7	1N4148 silicon small signal diode
LEDs(even)	5mm round LED, red
LEDs(odd)	5mm round LED, green
LEDs(zero)	5mm round LED, orange
Q1-4	BC549 NPN transistor
IC1	555 timer IC
IC2,3	4017 CMOS decade counter/decoder

Miscellaneous

PCB	122 x 91.5mm, coded ZA1204
SW1	Pushbutton switch, N/O momentary, red
Spkr	27mm diameter speaker, 8 ohms.

9V battery snap lead, length of tinned copper wire for links, etc.

projecting through the lid, without the tops of the other components hitting the lid.

Note that the red LEDs are used for the positions corresponding to the even numbers around the wheel (2, 4, etc.), and the green LEDs for the odd numbers. The two orange LEDs are used for the '00' position at the top and the '0' position at the bottom.

Next mount the pushbutton switch SW1. Mount this at a height that clears the top of the electrolytic capacitors if it is fixed to the lid of a case. A stack of washers or a second nut will get the lid to the right height, if necessary.

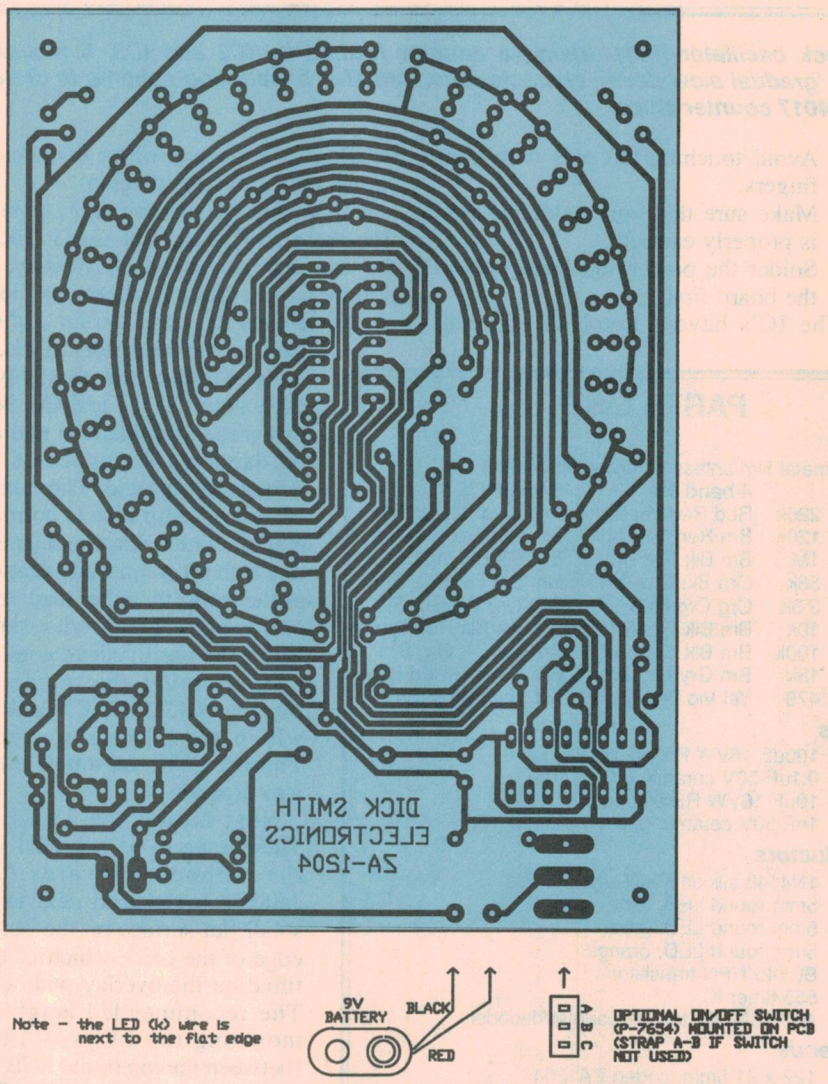
Provision has been made on the PCB near the battery terminals for mounting an on/off slider switch SW2 (DSE Cat No. P-7654). If one is installed, then solder it at a height to match thepushbutton.

Next connect the battery snap connector to the PCB.

The only thing left now is the speaker. This has been left until last so that it doesn't get damaged by accidently sticking your fingers into it while mounting other components.

To mount the speaker, first solder short lengths of tinned copper wire to each of its terminals, taking care not to apply too much heat. Then apply some glue or double-sided adhesive tape to the PCB where the speaker sits, insert the speaker wires into the PCB, press the speaker into position and finally solder the two wires.

With the assembly of the board complete, carefully check all the soldering. Look especially for dry solder joints, and solder 'bridges' shorting PCB tracks together. If all seems well, your wheel should now be ready for testing.



Use this PCB overlay diagram as a guide when you're wiring up the Roulette Wheel board. Note that there are quite a few wire links, most of which are inside the circle of LEDs. The LEDs themselves are colour coded — see text.

Wheel and table colours

The labels provided in the DSE kit for the roulette wheel and betting table should be coloured, perhaps with pencils or felt pens, as follows (the black numbers and the black diamond on the betting table are already black):

RED: 1, 36, 3, 34, 5, 32, 7, 30, 9, 14, 23, 16, 21, 18, 19, 12, 25, 27

BLACK: 13, 24, 15, 22, 17, 20, 11, 26, 28, 2, 35, 4, 33, 6, 31, 8, 29, 10

WHITE: 0, 00

One of the 'diamond' shapes on the betting table is already black; the other should be coloured red. All of the other boxes are left white (or some colour other than red or black).

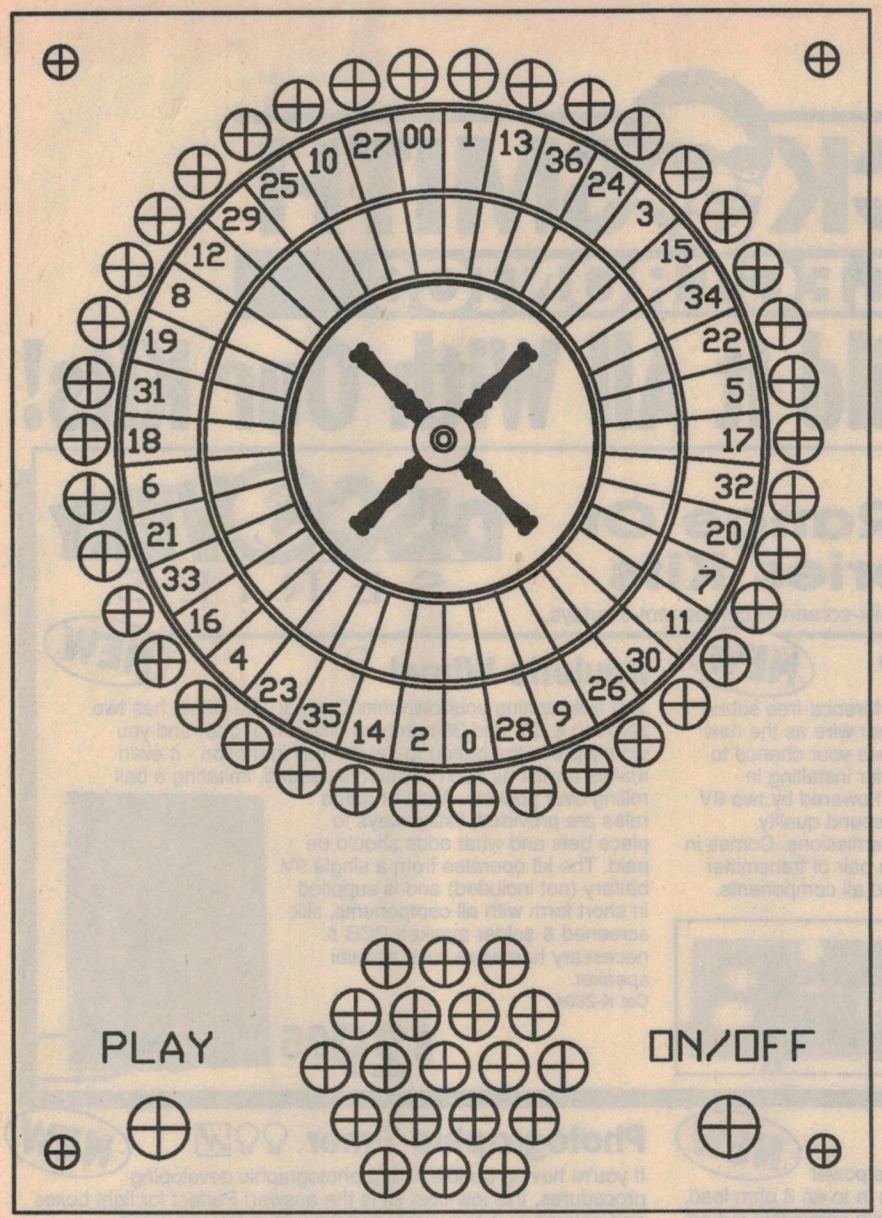
How it works

The heart of the circuit is a pulse generator, or clock, using IC1 — a 555 timer IC. The 555 is used as an inverting Schmitt trigger by connecting pins 2 and 6 to form the input, and pin 3 is the output. The way the Schmitt trigger works is that when pin 2 falls below Vcc/3 (VL) the output goes high, and when pin 6 rises above 2Vcc/3 (VH) the output goes low.

The components that determine the clock timing can be divided roughly into two groups. Firstly there is C1, R1 and R2, which determine the overall time that the ball 'rolls for' when SW1 is released; then there is R3, R4, R5 and C2, which determine how fast the ball rolls.

The time it takes for the ball to go from one number to the next — i.e., how fast the ball rolls — is equal to the time it takes C2 to charge from VL to VH, added to the time it takes to discharge again from VH to VL. The charge time is effectively fixed to 0.5ms by the charge path through R5 and D4, with D4 preventing C2 from discharging through the same path. The 0.5ms charge time is so short, compared to the discharge time, that the ball step time is very close to the discharge time alone. The discharge of C2 is via two paths: through R3 and through D1-3 and R4, into the positive electrode of C1.

When the play button is pressed, the positive electrode of C1 is at ground potential and the discharge rate is at its maximum with most of the discharge current flowing through R4. As C1 begins to charge (after the button is released), the voltage difference between C2 and C1 decreases and so



This artwork can be used for your front panel if you build the Roulette Wheel project into a jiffy box. The text explains how to give it the correct coding.

the discharge current decreases. To give that 'cliffhanger' slow finish, diodes D1-3 stop conducting when the voltage difference between C2 and C1 drops to about 1V, making R3 the only discharge path. When the voltage on C1 reaches VL, C2 can no longer discharge at all and the clock stops.

The output from the clock is fed to the speaker via capacitor C4, to produce a click for every step of the ball. (It actually produces a *double* click for every step, but the two clicks are only 0.5ms apart and are heard as a single click.) The clock pulse is then fed via a filter formed by R6 and C5, to remove a spike caused by the inductance of the speaker, which would otherwise cause false triggering of the following counter stage.

IC2 and IC3 are CMOS type decade counters which have their binary outputs internally decoded to give a 1 of 10 output, with the active output at a high voltage level. IC2 counts the clock output directly, providing the 'units' output, and at the count of 10 it produces a positive pulse at the carry output which is counted by the 'tens' counter IC3.

The tens outputs are then inverted by Q1-4 and combined with the units outputs to drive the 38 LEDs in a 10x4 matrix array. To prevent the counter from counting above 38, when the count reaches 39 the cathodes of D5 and D6 both go high, which allows R7 to pull the reset pins of IC2 and IC3 high and reset both counters to zero.

Full details of how to play roulette are given in the Dick Smith kit for this project. ❖

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Does your microcontroller make you wonder? The OC8031/52 SBC is a development solution that will put you in charge. It comes with 8052AH Basic chip allowing you to program in floating point basic, run it, and when happy with the results commit it to Eprom using the on board Eprom Programmer. If you wish to use your own compilor insert a plain vanilla 8031 instead.

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32K Eprom • 32K Ram • WDT • RTC • PWM • 16 channel 8 or 10 bit ADC (0-5V) • 16 digital Inputs, 8 digital Outputs (OC) • PWM • 5 Counter/Timers • 2 RS232 serial ports • I/O expansion port and screw terminals for easy connection.

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DISCOVERY SERIES

All PCBs come solder-masked and with silk-screened component overlays.

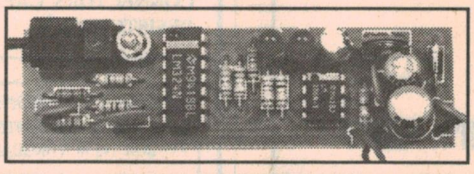
Fibre Optic Audio Link

NEW

Given the ability of fibre optics to deliver interference-free sound at the speed of light, it's fast taking over copper wire as the new standard for communications technology. Now's your chance to learn all about fibre optics! This kit is perfect for installing in devices that have noise problems, static etc. Powered by two 9V batteries, it makes a significant difference to sound quality, allowing you to listen to interference-free transmissions. Comes in short form with a length of optic fibre cable, a pair of transmitter and receiver devices, electret microphone and all components.

Cat K-2803

$49.95

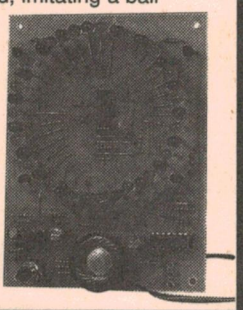


Roulette Wheel

NEW

Just like running your own mini Casino! The wheel has two zeros (0 & 00) and 36 numbers (like a real one) and you simply press the button to set the ball in motion - it even makes a click as each number is passed, imitating a ball rolling over pockets. A set of game rules are provided, listing ways to place bets and what odds should be paid. The kit operates from a single 9V battery (not included) and is supplied in short form with all components, silk-screened & solder masked PCB & necessary hardware such as mini speaker.

Cat K-2804



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Sub Woofer Amp

NEW

A sub woofer amplifier system with a continuous power capability of 320 watts into 4 ohms or 200 watts in to an 8 ohm load. It features a built-in two-way active cross-over with selectable cut-off frequencies, excellent noise and distortion performance plus, automatic signal muting when switched on and off. Provides frequency response of 10Hz to 70Hz/90Hz/120Hz (selectable) (Amplifier module:10Hz to 100KHz, 3dB) and Input Sensitivity/Impedance of 0.6v/47K for 200 watts RMS into 8 ohms. Comes with all components, hardware, transformer, pre-punched case (anodised matt black) & pre-punched silk screened front panel.

Cat K-5580

EA Apr '95 **$349**

Photographic Timer

NEW

If you're having trouble timing photographic developing procedures, this low-cost kit is the answer! Perfect for light boxes and enlargers, it accurately switches on mains-powered fluorescent ultra-violet tubes or incandescent lamps rated at up to 1200W for a pre-set time (1-450 seconds). It's perfect Power, Focus, Range, Start and Timer switches are all conveniently located on the front panel. The kit comes in short-form complete with all components, PCB, deluxe case, hardware and pre-punched silk-screened front panel.

Cat K-3022

$99.95

EA Apr '95 *Note: Case style may vary to illustrated model.*

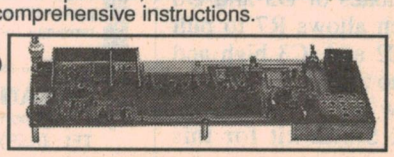
FM Radio Trainer

NEW

A great introduction to the basics of FM circuitry, this model is designed as a learning aid so it's easy to build. With an ultimate signal to noise ratio of 82dB, it provides top quality sound for all local stations and good reception for signals up to 70kms away. Supplied in short-form with all components, silk-screened and colour-coded PCB, hardware and comprehensive instructions.

Cat K-5026

$69.95



SILICON CHIP Apr '95

50 Watt Stereo Amplifier Module

Using two LM3886 monolithic power ICs, this stereo amplifier has no adjustments and delivers 50 watts per channel into 8-ohm loads or, with a reduced supply rail, 60 watts per channel into 4 ohm loads. With supply rails of 35V-0-35V and input sensitivity of 870mV RMS. Supplied in short form with all components, PCB and heatsinks.

Cat K-5612

NEW

$79.95

SILICON CHIP Feb '95

Please contact your nearest store for availability as some kits may still be in production.

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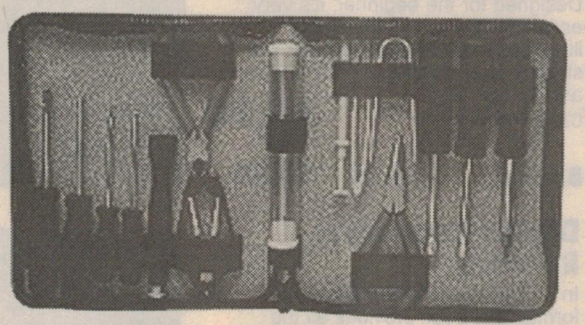

16-Piece Computer Servicing Kit

Complete With Case!

Do-it-yourself computer maintenance! Includes PLCC extractor and IC inserter, pliers, hex drivers, torx bits, screwdrivers, and a Pearl Catch, all in an attractive zippered case.
Cat T-4843

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BONUS
Soldering Iron
(T-2300)
Valued at $19.95

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NEW

You'll be able to check logic states at a glance! Power is obtained from the circuit being tested (4-16V) and High/Low/Pulse states are indicated by individual LEDs. With both audio and visual indication.
Cat Q-1273

$29.95

3.5 Digit Multimeter

This accurate 19-range meter measures AC/DC voltages, DC current and resistance, plus it's incredibly compact and easy to use! Has a diode test function, 10 Amp (DC) current range and a transistor test socket.
Cat Q-1425

$39.95

BONUS
Analogue Multimeter
(Q-1004)
Valued at $16.95.

Ranges:

DCV:	0.2V, 2V, 20V, 200V, 1000V
ACV:	200, 750V
DC Current:	200uA, 2000uA, 20mA, 200mA, 10A
Resistance:	200, 2K, 20K, 200K, 2M

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Cat W-2101

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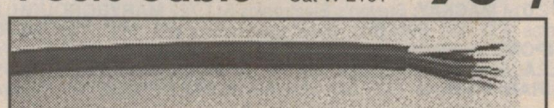

At These Prices, You Can Fill Your Shelves!

Six BD679 Projects

Ideal for experimenters, it covers six projects based on the BD679 Darlington transistor and even includes a bonus transistor! Additionally, it provides a computer evaluation project to fill you in on the technical side of computers.

Cat B-3638 **$3.50**

Electronics For Model Railways

A practical and easy-to-follow guide to electronics in model railways covering: Level crossing lights, signals, tunnel stretchers, fibre optics, computers & railways and more. A must for the radio enthusiast!

Cat B-3642 **$3.80**

14 FM Bugs To Build

A quality publication from Talking Electronics that demonstrates fourteen ways to build miniature FM transmitters and suggestions of how to put these to use. It's easy to read and fun to learn about electronics the hands-on way.

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5 More FM Bugs Cat B-3651 **$3.50**

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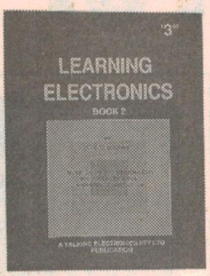

Digital Electronics Revealed

In a clear hand-written grid-page format, this book provides all the information you need to understand digital electronics equipment. Distributed exclusively through Dick Smith Electronics stores, it's a concise and easy to read publication.

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Their notebook style makes them more comprehensive and easier to follow than standard books on electronics. Ideal for students, technicians, teachers and enthusiasts.

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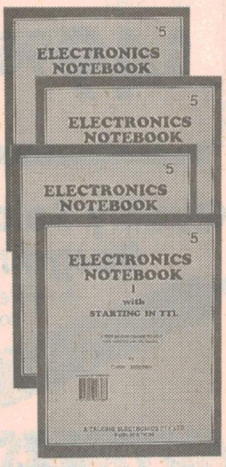

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Scanning And Sel-Call UHF CB

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Cat D-1799

NEW

1 year warranty uniden. **$399**

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Simple-to-use 10-channel scanning receiver for listening to known VHF/UHF services. Covers 66-88, 137-174, and 406-512MHz. Also great for listening to ethnic language services that don't operate on the FM broadcast band.

Cat D-2746

$169.95 uniden.

Uniden UH-053 UHF CB

Provides coverage of the first 16 channels of the UHF CB band, with selectable repeater operation on channels 1-8 inclusive. Simplex operation on all 16 channels is selectable if repeater access is not required. Supplied with a NiCad battery pack, AC charger, belt-clip, and flexible antenna, ready for operation. An optional speaker/microphone (D-2025) is also available for more convenient belt-mounted usage.

Cat D-1753

NEW

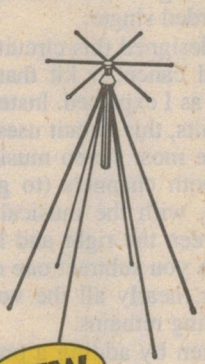
$269 uniden.

Breakthrough Price!

Scanner Discone Antenna

New from Benelec, this quality Australian-made scanner discone antenna provides excellent receive performance across the entire 60 to 1000MHz range, making it ideal for use with many of today's wide-band scanning receivers. It uses stainless-steel hose clamps for mounting the antenna to your mast. Uses an SO-239 in the base of the antenna for coax connection.

Cat D-4845



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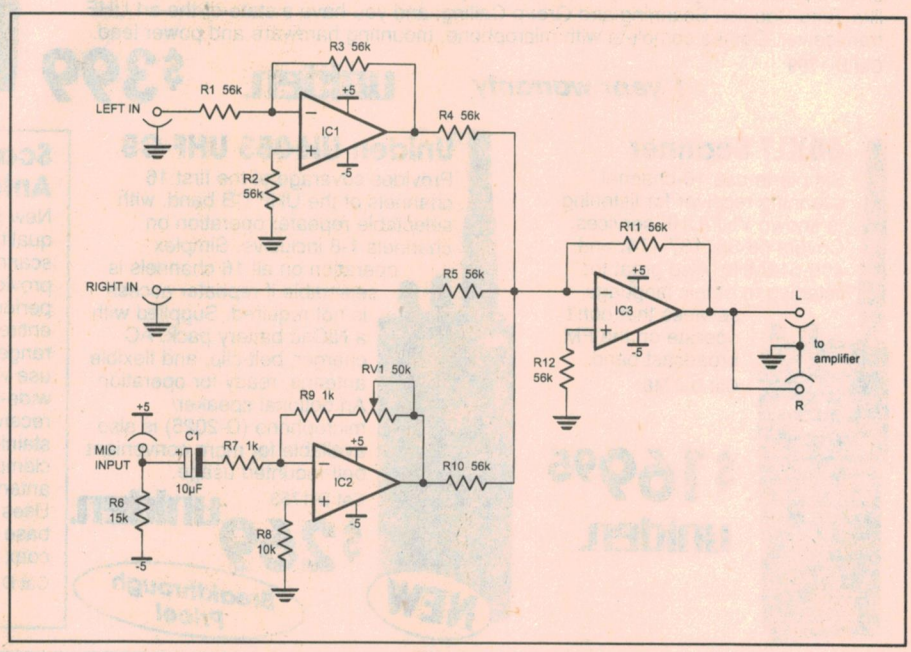
STORES ACROSS AUSTRALIA AND NEW ZEALAND

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Karaoke converter



This circuit is easy to build, inexpensive and, with most stereo music, it lets you sing to the backing instead of the recorded singer.

I designed this circuit after building a vocal canceller kit that didn't work as well as I expected. Instead of using filter circuits, this circuit uses subtraction, because most stereo music has the vocals on both channels (to give a centre effect), with the musical backing spread between the right and left channels. So when you subtract one channel from the other, nearly all the vocals go, but the backing remains.

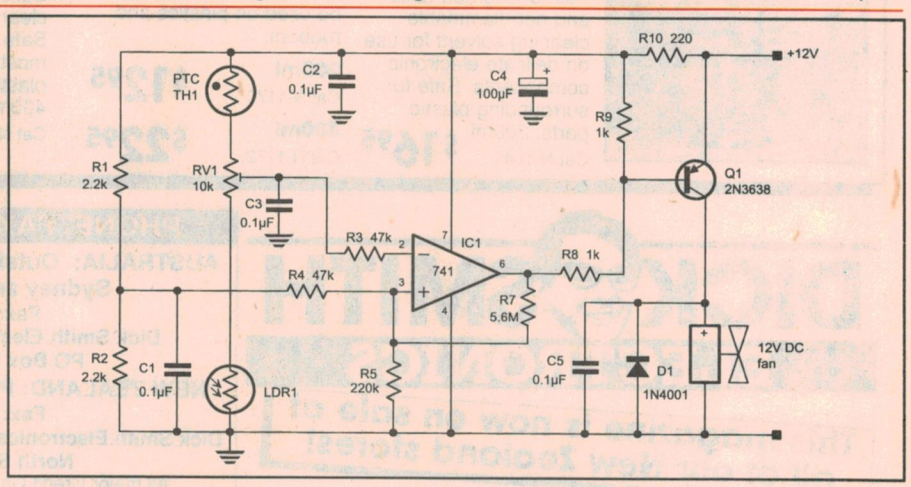
Then by adding a pre-amplifier connected to a microphone, your voice has a greater amplitude than the remaining vocal. The circuit works well with most CDs, except those recordings where the vocal is not in the centre of the sound image.

The inverting buffer of IC1 inverts the left signal, but without gain. Its output goes to IC3, which is connected as a summer. The right signal is also fed to this IC, but without inversion. If there's no output from IC2, the output of IC3 is therefore R-L, with the common mode signal (vocal) cancelled.

The output of the microphone is amplified by IC2. The gain of this stage is adjusted with RV1, to get the right balance. The resistance of R1 should equal the impedance of the microphone.

Richard Bisinella,
Lara, Vic. **$30**

Fridge cooler



This simple fan controller is for any small inefficient beer refrigerator. In my case, prior to this addition the beer 'fridge would not cool the contents to an acceptable temperature, and also had an agonising time lag after restocking the contents.

Supply for the circuit is from a 12 volt plug pack. The 741 op-amp is configured as an inverting Schmitt trigger, with a small amount of hysteresis. The PTC thermistor and the 10k potentiometer are used to stop the fan when the temperature of the 'fridge is about one degree.

The LDR stops the fan when the door is opened, preventing cold air spill. The fan is a standard 80 x 80 x 25mm, 12V DC 200mA fan switched by Q1, a PNP transistor driven by the output of the 741. The circuit was built on stripboard and housed in a small plastic box. The LDR is mounted on the side of the box and the box sealed with 'blue tack'.

The fan is mounted vertically in an aluminium housing, with the plastic box screwed to the side nearest the internal light. I opted to draw the warmer air from the top of the refrigerator and to direct the flow to the bottom. However as long as a positive air flow is established, the direction probably does not make much difference in a small refrigerator.

Certainly the room taken up by the unit is more than compensated for by the much reduced cooling time. I've found no problems with condensation on the components, as once everything is cooled to the temperature of the 'fridge, condensation stops. The only problem I had was a dry fan bearing (from new), which was cured with a few drops of oil.

Roly Border,
West Chermside, Qld. **$40**

In-circuit transistor tester

This circuit tests the gross switching capability of an in-circuit transistor, rather than its characteristics such as current gain.

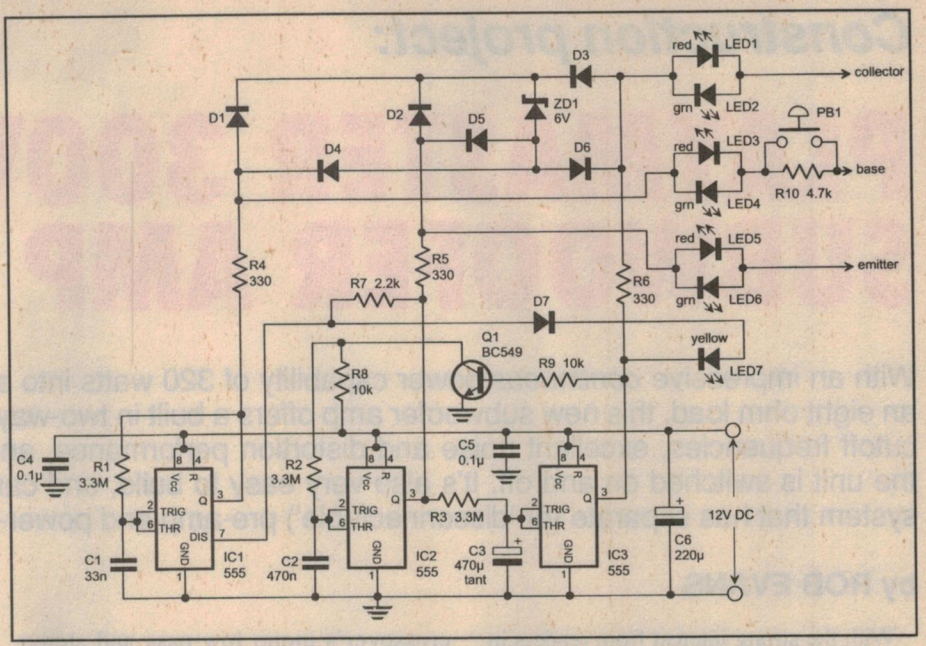
It works by applying voltages to the emitter and collector in a repeated sequence of four steps (each lasting about a second), while the base is fed with a 7Hz positive pulse.

The applied currents and voltages are limited, and current into and out of each transistor terminal is displayed on pairs of red and green LEDs. The result is a display sequence which indicates whether the device under test (DUT) is a good NPN or PNP transistor (includes Darlingtons), or if faulty, the nature of the fault.

Three 555 timers provide the necessary timing, while acting as drivers for the emitter, base and collector of the DUT. IC1 provides the (nominal) 0 to 12V pulses that supply base current, by using R1/C1 delayed feedback from its output to the trigger and threshold terminals. IC2, IC3 and Q1 are connected as a ring-of-three to get the overall phase inversion necessary for continuous sequencing. IC3 inverts the state of IC2, after a delay from R3 and C3, then IC1 copies the state of IC2 (using Q1 as an inverter) after a similar delay from R2 and C2. To prevent noise pickup, clip off the pin 5 lead on each IC.

The current out of each driver is limited by a 330-ohm series resistor, and the voltage applied to the DUT is held to a maximum of about 4V by ZD1. Its cathode is connected to the most positive of the three feeds by either of diodes D1-3, and its anode to the most negative by one of D4-6. (Voltage drops in D1-6 and the LEDs call for a 6V zener to achieve the desired 4V at the DUT. This voltage is chosen as it's below the usual reverse breakdown voltage of a transistor.) The base drive is further limited by R10, which can be shorted by pressing the pushbutton if the DUT is in a low resistance circuit.

The four testing phases (0 to 3) are E-/C-, E-/C+, E+/C+ and E+/C-, with B+/B- alternating continuously at about 7Hz. (- means 0V.) Phases 1 and 3 serve mainly to identify good devices, with 0 and 2 helping to identify the nature of a fault. LED7 helps you interpret some of the more obscure display combinations. It flashes during phase 3, when the emitter supply is positive with the collector at 0V.



A good transistor flashes a pair of LEDs (one red, one green) during at least one phase: synchronised with the red base LED3 for NPN or green (LED4) for PNP. Press the pushbutton for a brighter display, or to get more base current. The complementary E and C indication occurs in phases 1 and 3 for simple alloy transistors, or in either one for Darlingtons.

For a good NPN transistor, its collector is positive relative to its emitter during phase 1, and its base voltage pulses the device on and off. The resultant current flow flashes LED1 (collector-red) and LED6 (emitter-green), and the base current (drawn when the base is positive) flashes LED3.

During phase 3 its emitter is positive relative to the collector, and the DUT is in 'inverted' mode, turning on again when the base is positive. LED3 flashes, but now with LED2 (collector-green) LED5 (emitter-red). Darlington transistors have the same action in normal mode, but the inverted mode is blocked, so only one of the phases can get the complementary flash.

The same applies to PNP transistors, except the polarities and colours are interchanged, so that now the green base LED4 flashes.

A host of display combinations are possible, depending on the nature of the fault. For instance, E-C breakdown (with base opened) gives steady indications from LED5 and LED2 in phase 1 and from LED6 and LED1 in phase 3. The unit requires 12V DC at 50mA maximum.

Gordon Wormald,
Florey, ACT. **$50**

Light and sound trigger modification

I recently built the Light and Sound Trigger (EA March 1994), but found the need to regularly replace the 9V battery a problem.

I decided to power the unit instead by using the Mini 9V from 1.5V converter (EA May 1990). I constructed this circuit and fitted it into one half of a dual D cell battery clip. The other half holds a NiCad D cell.

A stereo 3.5mm jack socket was then fitted to the case of the Trigger, with the common and the innser 'channel' terminals strapped together and connected to the ground of the Trigger circuit. The outside 'channel' (which contacts the tip of the plug) connects to the 9V supply line of the Trigger circuit.

I wired the plug so its common terminal connected to the common of the converter circuit. The inner channel of the plug (between common and the tip) goes to the negative terminal of the NiCad cell, and the tip of the plug connects to the +9V output of the converter circuit.

The idea is that if the plug is not inserted into the socket, the NiCad Cell is disconnected from the converter circuit, preventing it from discharging. This arrangement could be used for any low power 9V device.

Tony Weedon,
Point Clare, NSW. **$25**

Construction project:

PLAYMASTER 300W SUBWOOFER AMP - 1

With an impressive *continuous* power capability of 320 watts into a four ohm load or 200 watts into an eight ohm load, this new subwoofer amp offers a built in two-way active crossover with selectable cutoff frequencies, excellent noise and distortion performance, and automatic signal muting when the unit is switched on and off. It's also very easy to build, and can be added to just about any hifi system that has separate (or 'disconnectable') pre-amp and power-amp stages.

by ROB EVANS

With the strong interest from readers in subwoofer systems over recent years, it's become increasingly clear that a dedicated *subwoofer* amplifier project is long overdue from the *Electronics Australia* lab. To some degree this need has been pushed along by the rising popularity of subwoofer based home 'theatre' sound systems — plus, of course, the number of subwoofer enclosures we've presented as construction projects in past issues.

As it happens, the last project of this type was described way back in the July 1982 issue of EA, and was a relatively simple affair with a power rating of around 100 watts and an integrated low-pass filter section to tailor the response of the incoming signals, as opposed to a full active crossover stage. While this worked quite well in practice, the subsequent 'Active crossover for subwoofers' unit published in the more recent September 1994 issue clearly showed us the advantages of using a full two-way active crossover with subwoofers.

To put it briefly, when using the latter unit the system's low end response is much smoother, due to the controlled (and matched in phase) roll-off slopes applied to both the main and subwoofer speakers, and it's much easier to acoustically integrate the two speaker systems by selecting the optimum crossover frequency with the front panel control. We found the improvement to be very impressive indeed, and as you've no doubt guessed, the same design has been incorporated in our new subwoofer amplifier.

In the process of including the crossover circuit in the subwoofer amp we've also added a simple muting circuit, which briefly inhibits signals to both the internal and the main external power amplifiers during power transitions. In practice, the crossover's mono low-pass and stereo high-pass outputs are muted when power is both applied and removed, so assuming that the actual amplifier modules do not generate significant transients of their own, there is no nasty turn-on or turn-off thumps through any of the system's speakers. And since the amplifier module used in the new subwoofer amp has been developed from the Pro Series Three amplifier design (February/March 1994), which is quite 'thump free', this simple muting system works well.

Which brings us to the amplifier module itself. As you can see from the schematic diagram presented here, the only significant change from the original Pro Series Three design is the addition of a third set of complementary power MOSFETs, Q11 and Q14. These increase both the transconductance and current capability of the output stage in one stroke, which promotes a larger output swing under load by lowering the output stage's effective 'on' resistance. It also safely spreads the power dissipation through more devices.

The result is a substantial increase in the amplifier's output power capability, so that our new design should satisfy the most power hungry speakers and of course, those with a penchant for ear-shattering volume levels.

We've also taken some effort to ensure that this project is easy to put together, as was the Pro Series Three amplifier. While the amplifier module uses the same simple MOSFET clamping bracket arrangement as before, there is no longer any need to mount the T0-126 driver transistors onto the bracket, as they are now free standing in the main

SPECIFICATIONS

Continuous power output:	200W RMS into eight ohms 320W RMS into four ohms
IHF power output (short term):	240W RMS into eight ohms 430W RMS into four ohms
Harmonic distortion (THD):	0.003% at 180W into eight ohms 0.005% at 300W into four ohms
Signal to Noise ratio (unweighted):	>95dB with respect to 100W RMS
Frequency response:	10Hz to 70Hz/90Hz/120Hz (selectable) (amplifier module: 10Hz to 100kHz, -3dB)
Crossover filtering:	-12dB/octave slopes, matched phase for HP/LP outputs
Damping factor:	>300 at 200W into eight ohms
Input sensitivity/impedance:	0.6V/47k for 200W RMS into eight ohms
Overload indicator:	Activated if output THD exceeds approx 0.05% (regardless of load impedance)
Muting:	Applied to both LP and HP outputs at power on/off

body of the circuit board. This has been achieved by reducing the standing current through these devices, thereby eliminating the need for the heatsinking effect of the clamping bracket. Note that there has been no measurable (or discernible) change in the amp's performance through this alteration.

So by combining (plus enhancing) the proven and effective designs from our free standing active crossover and the Pro Series Three amp, we're able to offer a subwoofer amplifier that delivers first class performance and a useful range of features. If you would like to know more about the design philosophy behind both of these past projects, we suggest that you refer back to the relevant issues, as mentioned above.

And by the way, we'd like to thank Jaycar Electronics for their kind assistance in supplying key components and the box assembly for this project.

Crossover circuit

The subwoofer amp's active crossover circuit is identical to free standing unit presented in the September 1994 issue, except that in this case we've added the signal muting circuitry based around IC4 and transistors Q17 to Q19 — as shown in the schematic of the filter circuit.

Considering the filter's left channel high-pass output (SKT2) for a moment, you can see that R43 and the collector-emitter junctions of Q17 form a simple voltage divider at the output of IC1b. This allows Q17 to severely attenuate (mute) the signal when forward biased by a high level on the 'mute control line', which is applied via limiting resistor R44 and isolating diode D5. The diode allows the transistor's base connection to effectively 'float' when the control line is low (muting off), so that large signal levels cannot force Q17's collector-base junction into reverse voltage breakdown.

As you would expect, the two remaining attenuator circuits (based around Q18 and Q19) operate in the same manner, and mute the signals at the mono low-pass and right channel high-pass outputs, respectively. All three circuits are driven from the mute control line which connects directly to the output of IC4, the basis of the power-on/off detector stage.

Here, IC4 acts as a simple comparator with a small degree of hysteresis provided by R73, and ultimately responds to a change in the state of its power supply rails VS+ and VS-. When power is first applied to the unit C52 rapidly charges via D10, applying power to IC4 at pins 7 and 4, while the combination of R70 and R71 set the op-amp's non-inverting input to a level of about -1V.

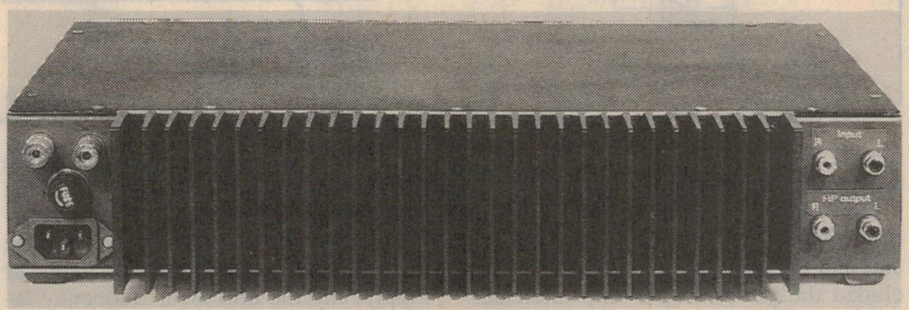
Since C53 is in a discharged state at this point, the op-amp's inverting input is held at a level close to VS-, thereby forcing the comparator's output high. This then activates the muting transistors Q17 to Q19, as described above, and illuminates the 'mute' indicator (LED5) via R74, Q20 and limiting resistor R75.

C53 then slowly charges via R72 until the voltage level at IC4's inverting input (pin 2) exceeds that of the non-inverting input (pin 3), where the comparator's output returns to a low level and the muting process is terminated. Thus the audio signals to both the subwoofer and main amplifiers are shut off for a short period (about a second) after power is first applied, then passed without restriction during normal use.

When power to the unit is shut off however, a further muting action is generated by IC4 in response to the falling supply rail voltages. In this case, while both VS+ and VS- quickly drop to around zero volts, the positive supply at pin 7 of IC4 is maintained at about 16V by the storage action of C52 — which is isolated from VS+ by D10, of course.

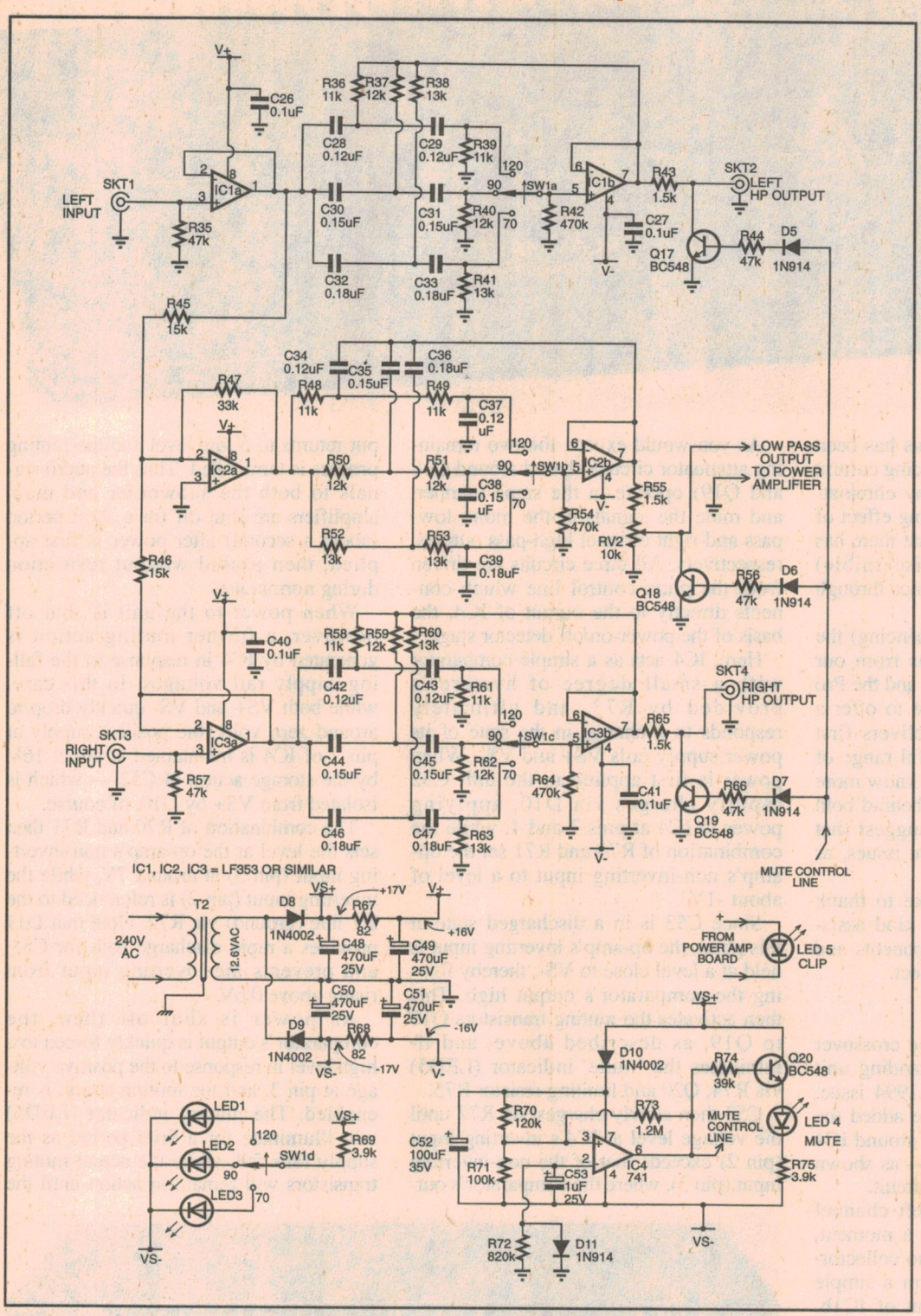
The combination of R70 and R71 then sets the level at the op-amp's non-inverting input (pin 3) at around 7V, while the inverting input (pin 2) is referenced to the 0V line (ground) via R72. Note that D11 provides a rapid discharge path for C53, and prevents the inverting input from rising above 0.6V.

As power is shut off then, the comparator's output is quickly forced to a high level in response to the positive voltage at pin 3, and the muting action is re-enabled. The muting indicator (LED5) will illuminate for a brief period as the supply rails fall, while the actual muting transistors will remain in action until the



The amp's rear side panels hold the signal in/out sockets (shown on the right) and the speaker terminals plus the mains socket and fuse holder (on the left). While the latter panel is a little crowded, it's quite functional in practice.

Playmaster 300W Subwoofer Amp - 1



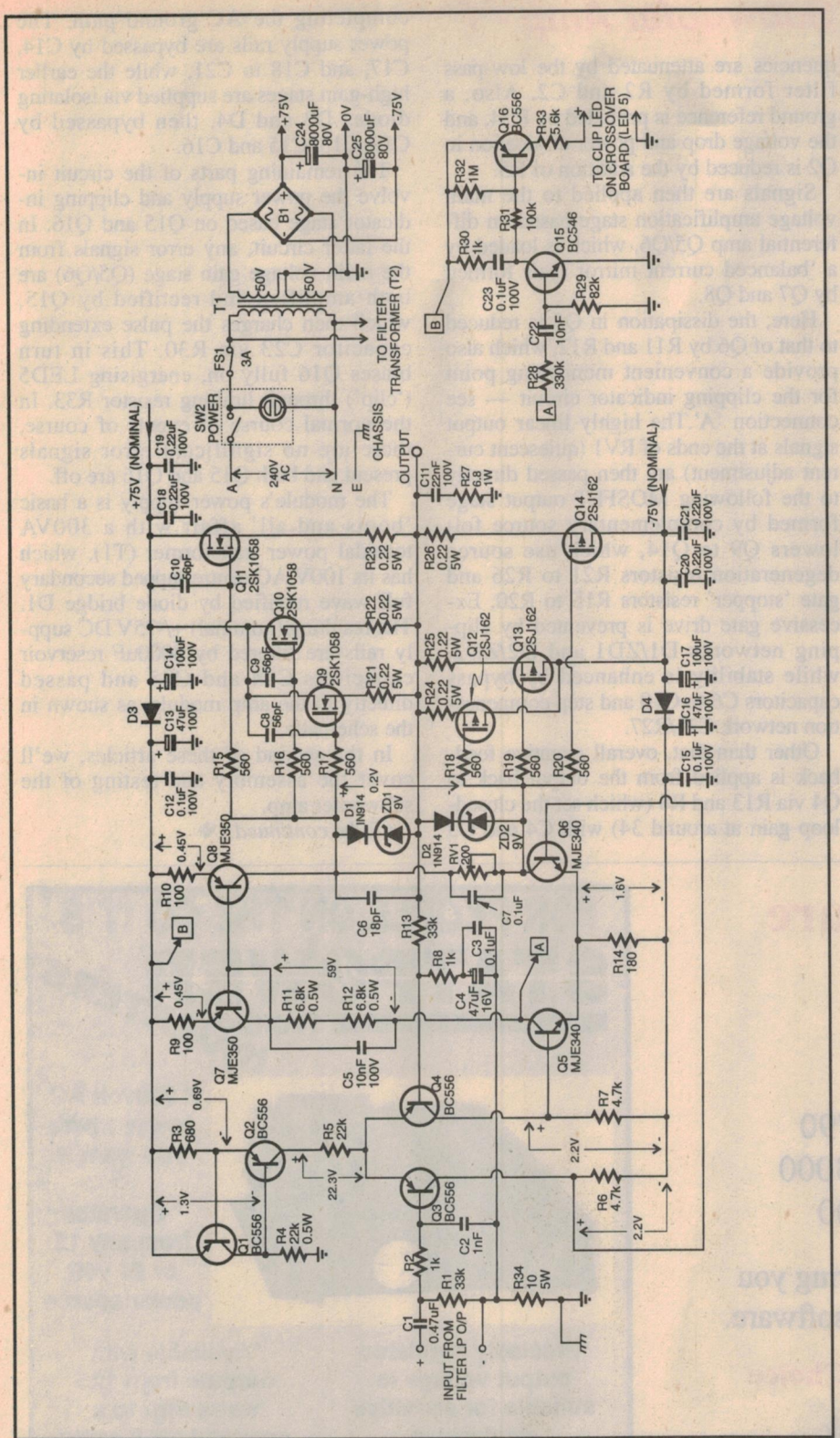
The subwoofer amp's active crossover circuit incorporates three second order Linkwitz-Riley filter stages (one low pass and two high pass), and a simple comparator stage (IC4) to control the signal muting.

output of IC4 finally drops after C52's energy is exhausted.

Other than the muting circuitry, the only real difference between our new circuit and the past design is that we've included the power amp's 'clip' indicator (LED4) on the filter board, as this makes for a neater result and easier construction technique — in fact, all of the filter's indicator LEDs (LED1 through to LED5) are now mounted directly on the circuit board, for these reasons.

The remaining circuitry around the muting stage includes the filter's power supply, and the crossover frequency indicating LEDs. SW1d is used to connect LED1, LED2 or LED3 to current limiting resistor R69, to indicate a crossover setting of 120Hz, 90Hz or 70Hzrespectively.

The power supply itself is a rather basic affair, where the (nominally) 12.6V AC secondary voltage of a 2851-type transformer is half wave rectified by D8 and D9 to produce the positive (VS+) and negative (VS-) supply rails, respectively, and filtered by reservoir capacitors C48



The amplifier module is a beefed up version of the circuit used in our Pro Series Three stereo power amp — note the extra set of complementary power MOSFETs, Q11 and Q14.

and C50. V+ and V- (which supply the op-amps) are then developed through the additional filtering action of R67/C49 and R68/C51, respectively.

As you can see from the remaining section of the filter board's schematic, the actual crossover circuit uses three dual op-amps (LF353 type) to produce the left and right channel high-pass signals for the external stereo power amp, and the mono low-pass signal for the internal amplifier module. All of the filters conform to a second order Linkwitz-Riley configuration, by the way.

Considering the left input for the moment, you can see that IC1a acts a unity gain buffer which passes the input signal to both the following high-pass filter circuit (based around IC1b), and a simple adding stage formed around IC2a. Here, the buffered left and right signals are mixed together with a gain of around two (as set by R45/R46 and R47), then passed to the low-pass filter stage based on IC2b which uses an equal value 'Sallen and Key' network arrangement. Note that there is a separate network for each crossover frequency (encompassing components C34 to C39, and R48 to R53), and these are selected by SW1b.

The high-pass filter stages based on IC1b (left) and IC3a (right) are configured in the same manner as the low-pass circuit, except of course that the filter networks are arranged in a reciprocal manner so as to the produce the appropriate high-pass response, with a matching phase characteristic. The left and right outputs at IC1b and IC3b are connected directly to the muting stages as described above, while the low-pass output at IC2b (pin 7) is applied via the subwoofer output level control, RV2.

Amplifier circuit

As with the crossover circuitry, the amp module circuit is an enhancement on a previous and well proven design — in this case, the Pro Series Three amplifier. The arrangement has been beefed up somewhat by the addition of the extra set of power MOSFETs (Q11 and Q14 in the schematic), and a few minor sections of the circuit altered to accommodate this new arrangement.

The amp's basic design is quite straightforward thanks to the simple nature of the MOSFET output stage, and as it happens, was covered in some depth in the Pro Series amplifier articles from previous issues — namely, the Pro Series One amp from December 1989 and the abovementioned Pro Series Three article. So rather than embarking on a long-winded discussion about the circuit here, we'll keep the description brief and recommend that those interested in the finer workings of the circuit refer back to those previous issues.

As you can see from the amplifier's schematic, signals are applied to a differential input stage based around Q3 and Q4, which is fed from a 1mA constant current source formed by Q1 and Q2. The input is isolated from DC by C1, referenced to 0V by R1, while very high fre-

NOTES AND ERRATA

Shoestring Stereo Amplifier (December 1994): The schematic diagram on page 59 should show C12's negative (rather than positive) terminal connected to pin 3 of IC3. Also, while all of the overlay diagram's connections are correct, the labelling of the +/-21V supply wires on the power amp PCB is reversed — that is, '-' should be near the top (connecting to pin 3 of IC3), and '+' at the bottom (pin 5).

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Subwoofer Amp - 1

quencies are attenuated by the low-pass filter formed by R2 and C2. Also, a ground reference is provided by R34, and the voltage drop and power dissipation in Q2 is reduced by the addition of R5.

Signals are then applied to the main voltage amplification stage based on differential amp Q5/Q6, which is loaded by a 'balanced current mirror' pair formed by Q7 and Q8.

Here, the dissipation in Q5 is reduced to that of Q6 by R11 and R12, which also provide a convenient monitoring point for the clipping indicator circuit — see connection 'A'.The highly linear output signals at the ends of RV1 (quiescent current adjustment) are then passed directly to the following MOSFET output stage formed by complementary source followers Q9 to Q14, which use source degeneration resistors R21 to R26 and gate 'stopper' resistors R15 to R20. Excessive gate drive is prevented by clipping networks D1/ZD1 and D2/ZD2, while stability is enhanced by bypass capacitors C6 to C10 and step compensation network C11/R27.

Other than that, overall negative feedback is applied from the output back to Q4 via R13 and R8 (which set the closed-loop gain at around 34) with C4 and C3 completing the AC ground path. The power supply rails are bypassed by C14, C17, and C18 to C21, while the earlier high-gain stages are supplied via isolating diodes D3 and D4, then bypassed by C12, C13, C15 and C16.

The remaining parts of the circuit involve the power supply and clipping indicator stage based on Q15 and Q16. In the latter circuit, any error signals from the main voltage gain stage (Q5/Q6) are both amplified and rectified by Q15, which then charges the pulse extending capacitor C23 via R30. This in turn biases Q16 fully on, energising LED5 ('clip') through limiting resistor R33. In the normal course of events of course, there are no significant error signals present and both Q15 and Q16 are off.

The module's power supply is a basic 'boots and all' affair with a 300VA toroidal power transformer (T1), which has its 100V AC centre-tapped secondary full wave rectified by diode bridge D1. The resulting (nominal) +/-75V DC supply rails are filtered by 8000uF reservoir capacitors C24 and C25 and passed directly to the amp module, as shown in the schematic.

In the second of these articles, we'll cover the assembly and testing of the subwoofer amp.

(To be continued.) ❖

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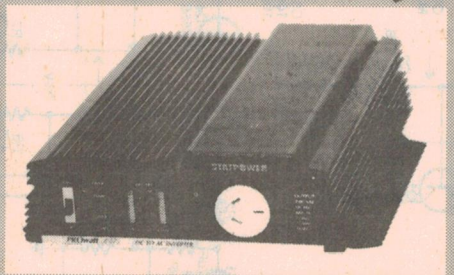

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EASOF486-Feb95S

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YOUR FIRST CHOICE IN QUALITY ELECTRONICS A.C.N. 005 428 437 ESTABLISHED SINCE 1977

NEW KITS NEW KITS NEW KITS

DIGITAL TRIGGER ADAPTOR FOR SCOPES

With eight inputs (expandable to 24), this useful device will monitor almost any digital circuit and trigger your oscilloscope only when a preset combination of inputs is found. It also includes an adjustable triggering delay, so it can effectively convert your scope into a low cost logic analyser.

ELECTRONIC AUST ***April '95***

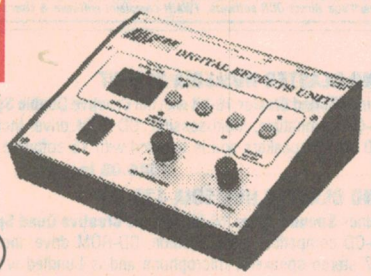
NEW

K10660 **CALL FOR INFO & PRICING**

DIGITAL EFFECTS UNIT FOR MUSICIANS

This neat Digital Effects Unit can produce a wide range of sound effects to enhance a musical instrument. It can be driven from a guitar or line source (or form both) & uses the latest in digital delay technology.

Silicon Chip FEB '95



NEW K10655 **$138.50**

BEGINNER'S VARIABLE DUAL-RAIL POWER SUPPLY

If you are just beginning in electronics, then you'll properly baulk at building a mains-operated power supply. This project uses a plugpack which means that you can make your own variable dual-rail power supply without worrying about mains wiring.

Needs plug pack M19017. ***Silicon Chip Oct '94***

NEW LOWER PRICE!!

K10635 ~~$59.95~~ **$39.95**

PLUG PACK

A plug in style power supply with fixed 16VAC output ideal for use with alarm control panels. Tinned ends for hard wiring to the panel. Australian safety standard AS3108

INPUT: 240VAC 50Hz

OUTPUT: 16VAC unregulated

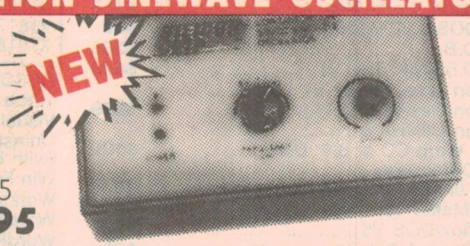
CURRENT: 1500mA

M19017 **$25.95**

3-SPOT LOW DISTORTION SINEWAVE OSCILLATOR

This sinewave oscillator is ideal for testing audio equipment & loudspeakers. It provides three switch-selectable spot frequencies at 100Hz, 1kHz & 10kHz, with levels up to 3V RMS & less than 0.004% distortion.

Silicon Chip Dec' 94



NEW

K10645 **$49.95**

A BUDGET PRICED "SHOESTRING" STEREO AMP

NEW

GREAT VALUE! IDEAL FOR SCHOOL PROJECT OR MULTIMEDIA.

K10650 **$99.95**

With a power rating of around 15 watts per channel and impressive noise and distortion performance, this new low cost amplifier is ideal for small hi-fi systems, "home theatre" installations, and a host of other applications. It uses readily available parts, offers a basic range of features, and is very easy to put together. Ideal for school. College or University project or built to work as a computer multimedia amplifier.

EA Dec'94

EAKITA95

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KITS KITS KITS KITS KITS KITS KITS

CAT	Description	R.R.P
K10005	SOLAR VOLTAGE REGULATOR	$13.95
K10040	ETI 480 50W AMP	$27.95
K10045	ETI 480 100W AMP	$34.95
K10050	ETI 480 POWER SUPPLY	$28.95
K10060	BALANCED MICROPHONE AMPLIFIER	$12.95
K10065	GENERAL PURPOSE AMPLIFIER	$14.95
K10070	BALANCED INPUT DIFFERENTIAL PREAMP	$19.95
K10075	FLOAT NICAD CHARGER	$14.95
K10080	TRANSISTOR TESTER	$22.95
K10085	300W PLAYMASTER AMP	$119.00
K10095	2 TONE ALARM	$9.95
K10100	1.5V TO 9V DC CONVERTER	$13.95
K10105	3 DIGIT COUNTER	$23.95
K10110	ELECTRIC FENCE	$23.95
K10115	ELECTRIC FENCE CONTROLLER	$61.95
K10120	TV PATTERN GENERATOR	$109.00
K10125	UNIVERSAL POWER SUPPLY	$12.95
K10135	LED SCANNER	$17.95
K10140	LOW FUEL INDICATOR FOR CAR	$11.95
K10145	SCREECHER CAR ALARM	$36.95
K10150	12/24V LIGHT CHASER	$21.95
K10160	THERMOSTATIC SWITCH FOR RADIATOR FANS	$31.95
K10180	STEREO FM TRANSMITTER	$33.95
K10155	LOW VOLTAGE CUTOUT FOR CAR /BOAT	$22.95
K10200	IN-CIRCUIT TRANSISTOR TESTER	$14.95
K10205	VHF POWERMATCH	$74.95
K10215	TEMPERATURE PROBE FOR MULTIMETERS	$19.95
K10225	18V / 1AMP BENCH TOP POWER SUPPLY	$79.95
K10260	INVERTER 2KW (NON ASSEMBLED)	$1,495.00
K10265	INVERTER 2KW ASSEMBLED & TESTED	$1,895.00
K10295	LOW OHMS METER	$29.95
K10300	TEMPERATURE ADAPTOR	$24.95
K10305	VOICE OPERATED RELAY	$19.95
K10310	IGNITION KILLER	$22.95
K10315	HEADPHONE AMPLIFIER	$34.95
K10320	VIDEO RF MODULATOR	$17.95
K10325	50W AUDIO AMPLIFIER	$54.95
E10325	PCB 50W AUDIO AMPLIFIER TDA1514A	$19.95
K10335	RGB TO PAL ENCODER MODULE	$49.95
K10340	CAMCORDER MIXER	$29.95
K10345	KARAOKE BOX	$28.95
K10350	REMOTE CONTROL EXTENDER FOR VCRS	$32.95
K10355	HIGH ENERGY IGNITION	$65.00
K10356	BREAKERLESS IGNITION	$44.95
K10360	LOUDSPEAKER PROTECTOR	$29.95
K10370	PORT. 12V LEAD ACID BATTERY CHARGER	$27.95
K10375	15W 12-240V INVERTER	$49.95
K10380	1GHz DIGITAL FREQUENCY COUNTER	$147.95
K10390	LOW COST QUIZ GAME ADJUDICATOR	$34.95
K10400	WOOFER STOPPER	$55.95
K10405	COLOUR VIDEO FADER	$32.95
K10415	PC-CONTROLLED EPROM PROGRAMMER	$99.95
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K10430	REMOTE CONTROL ELECT. COCKROACH	$69.95
K10440	HIGH EFFICIENCY FLUORO INVERTER KIT	$49.95
K10445	IMPROVED DECODER FOR ACS SIGNALS	$19.95
K10450	A SIMPLE LOW VOLTAGE SPEED CONTROLLER	$13.95
K10455	PRINTER STATUS INDICATOR FOR PRINTERS	$65.95
K10465	LOW COST 25W AMPLIFIER MODULE	$18.95
K10460	VERSATILE 40V / 3A LAB POWER SUPPLY	$165.95
K10470	CHAMP 0.5 WATT AMPLIFIER	$9.95
K10475*	90 SECOND MESSAGE HOLDER	$97.95
K10476	75 SECOND MESSAGE HOLDER	$93.95
K10480	CONTROL STEPPER MOTORS WITH YOUR PC	$65.95
K10485	EGO TESTER KIT	$19.95
K10490	LOW COST MIDI BREAK-OUT BOX	$32.95
K10495	200W INVERTER KIT	$199.95
K10500	VOICE OPERATED AUDIO SWITCH	$12.95
K10505	SIMPLE LED CHASER	$21.95
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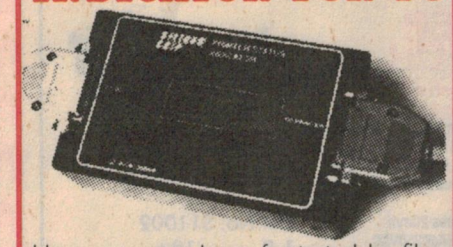
K10515	SOUNDS & LIGHTS FOR LEVEL CROSSING	$37.95
K10520	AN IMPROVED DSO ADAPTOR FOR PC'S	$158.95
K10521	DSO ADAPTOR (INCLUDES ADC0861)	$168.95
K10525	WEEKLY REMINDER TEMP	$19.95
K10530	L/NOISE UNI. STEREO PREAMP	$19.95
K10535	LIGHT & SOUND TRIGGER	$41.95
K10540	50W AUDIO AMPLIFIER	$37.50
K10545	IND. METAL BALANCE DETECTOR	$58.95
K10550	FAST CHARGER FOR NICAD	$42.95
K10555	DUAL ELECTRONIC DICE	$24.95
K10560	DIGITAL VOLTMETER FOR CARS	$40.95
K10565	DIGITAL TACHOMETER FOR CARS	$57.95
K10570	COOLANT LEVEL ALARM	$29.95
K10575	STEAM TRAIN WHISTLE & DIESEL HORN SIMULATOR	$22.45
K10580	BUDGET PRICED TEMPERATURE CONTROL	$39.95
K10585	HIGH-POWER DIMMER FOR INCANDESCENT LAMPS	$69.95
K10595	NICAD ZAPPER	$29.95
K10600	GO/NO-GO CRYSTAL CHECKER	$19.95
K10605	CHAMP PRE-AMP	$9.95
K10610	MINIVOX VOICE OPERATED RELAY	$14.95
K10615*	LONG-WAVE AM RECEIVER FOR AIRCRAFT WEATHER INFORMATION	$49.50
K10620	AUTO DISCHARGER FOR NICAD BATTERY PACKS	$27.95
K10625*	ELECTRONIC BALLAST FOR FLUORESCENT LAMPS	$59.95
K10630	TALKING HEADLIGHTS REMINDER	$79.95
K10635	BEGINNER'S VARIABLE DUAL-RAIL POWER SUPPLY	$39.95
K10640	CLIFFORD-A PESKY LITTLE ELECTRONIC CRICKET	$16.45
K10645	3-SPOT LOW DISTORTION SINEWAVE OSCILLATOR	$49.95
K10650	A BUDGET PRICED "SHOESTRING" STEREO AMP	$99.95
K10655*	DIGITAL EFFECTS UNIT FOR MUSICIANS	$138.50
K10660*	DIGITAL TRIGGER ADAPTOR FOR SCOPES	CALL

*SOON AVAILABLE

PRINTER STATUS INDICATOR FOR PC



Have you ever been frustrated by files disappearing down your printer cable & not appearing at the other end? This Printer Status Indicator uses any alphanumeric display to indicate any errors that occur during transmission.

Silicon Chip Jan'94

K10455 **$65.95**

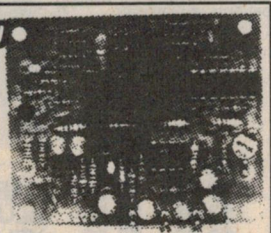
BUDGET PRICED TEMPERATURE CONTROL

This handy and compact unit can switch 10 amps at 240V AC under the control of a temperature sensor - and it's budget-priced. The temperature setting must be calibrated manually, but can be set from sub-zero temperatures, to around 100 degrees Celsius or more. A PCB jumper allows the unit to be set to switch the circuit's relay either on or off when the desired temperature is exceeded.

EA August '94

K10580 **$39.95**

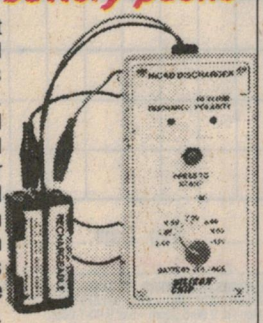
IMPROVED DECODER FOR ACS SIGNALS



K10445 **$19.95**

Many Australian FM broadcasters are now radiating either one or two "piggyback" ACS subcarrier signals. This new low cost decoder when added to a FM receiver, will pick up those hidden signals at the flick of a switch. This new design overcome some of the shortcomings of earlier designs. *EA Oct'93*

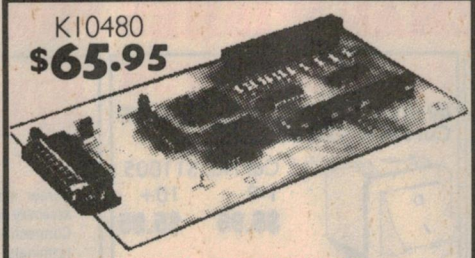
Automatic discharger for Nicad battery packs



If you own equipment which uses nicad batteries, then this discharger is for you. Use correctly, it will maintain the full capacity of your battery pack & extend its useful life. It can even rejuvenate an old battery pack that's suffering from the memory effect.

Silicon Chip Sept. '94

K10620 **$27.95**



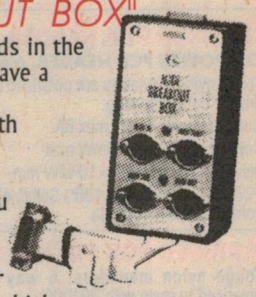
K10480 **$65.95**

CONTROL STEPPER MOTORS WITH YOUR PC

Discover how stepper motor works and how you may control them using your PC with this kit. A ready source of stepper motors can be found in "dead" hard discs or floppies drives.

EA Jan '94

LOW COST MIDI "BREAKOUT BOX"



Most sound cards in the market do not have a MIDI port to communicate with external music keyboards and synthesisers. You would need a special MIDI adaptor cable or "breakout box", which are hard to find. Build one yourself with this kit. *EA Feb'94*

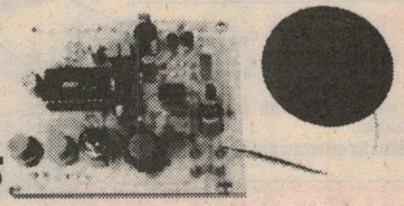
K10490 **$32.95**

75 SECOND MESSAGE RECORDER

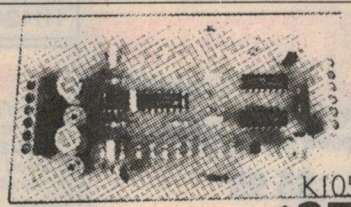
This 75-second message recorder runs from a 6V battery and features more power output, a pause button, 75 seconds of continous recording time and zero-power memory storage.

Silicon Chip Feb '94

Now available- 90 Second Message Recorder K10475...$97.95



K10476 **$93.95**



K10510 **$27.95**

LEVEL CROSSING DETECTOR FOR MODEL

Add realism to your model train layout with this level crossing circuitry. It will detect the approach of a train, monitor its passing & provide an output to control circuitry to flash lights & sound a synthesised bell

Silicon Chip March '94

CLIFFORD- A PESKY LITTLE ELECTRONIC CRICKET

K10640 **$16.45**

Meet Clifford - our new little pesky insect friend. A cousin of Horace the Cricket, he has a lot to say - provided it's dark. He's easy to look after & doesn't eat very much - one 9V battery will do him for a month! **Silicon Chip Dec' 94**

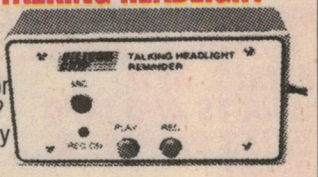
NICAD ZAPPER

K10595 **$29.95**

Do you have a few suspect Nicad batteries lying around in your kitchen drawer? Why not try bringing them back to life with this Nicad Zapper? It zaps the cell with a high-voltage, high-current burst to blast away any internal shorts caused by dendrites.

Silicon Chip August '94

BUILD THIS TALKING HEADLIGHT REMINDER



Ever leave your car's headlights or parking lights on? Flatten the battery too? If so, you need this talking headlight reminder. If you accidentally leave your headlights on, it tells you to switch them off.

(Silicon Chip Oct. '94)

K10630 **$79.95**

HIGH ENERGY IGNITION SYSTEM

Is your car still limping along with outdated kettering ignition? What? You're still cleaning points, adjusting dwell, checking timer and all that automotive drudgery? Now you can fit this High Energy Ignition System and forget those tune-up hassles. *(Silicon Chip May. '88)*

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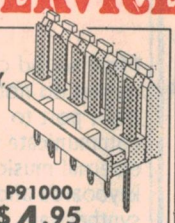
WHAT THE SERVICEMAN WISHES FOR IN HIS TOOL BOX

POLARISED PCB HEADER

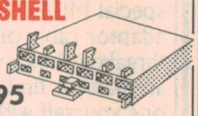
HIGH POWER PCB HEADER, 6WAY.



- Tough nylon insulators are polarised to ensure correct mating.
- Current ratung 6 way max 8A
- Contact resistance 10mW max
- Insulation resistance >10^3MW min
- PCB pitch 3.96mm (0.156") Suitable for computer motherboards

P91000 **$4.95**

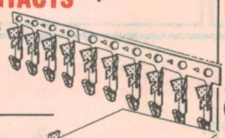
POLARISED PCB SOCKET SHELL



- Tough nylon insulators, 6 way polarised to mate with P91000
- No crimp contacts

P91002 **$2.95**

POLARISED CRIMP CONTACTS

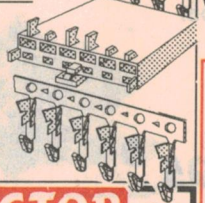


- Bandoliers of 10, Tin plated brass
- Will accept 0.5 - 1.5mm wires

P9100 **$2.95**

POLARISED PCB SOCKETS AND CONTACTS

P91004 **$5.95**



- T6 way socket with 6 contact Bandoliers

Suitable for computer power supplies

CPU EXTRACTOR

Changing CPU over is a breeze with this extractor. Save your CPU from damage!

T12181 **$6.95**

GENIUNE INTEL TOOL, DESIGNED FOR CERAMIC CPUS.

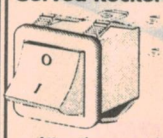
TERMINAL STRIPS (Chocolate block)

Now you rewire anything from a telephone or intercom system to an 80 amp Solar Array. They are so reasonably priced you can afford to keep a couple of each in your tool box. Come in and see our huge range.

Cat No.	Description	1-9	10+
P18051	3 amp - cable entry 3.0mm	$0.95	$0.80
P18053	6 amp - cable entry 3.3mm	$1.20	$1.00
P18055	30 amp - cable entry 5.6mm	$1.95	$1.70
P18057	60 amp - cable entry 7.0mm	$2.95	$2.20
P18059	80 amp - cable entry 7.0mm	$3.95	$3.00

ON-OFF SWITCH

IN STOCK FOR COMPUTER CASE
Curved Rocker Switch



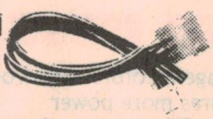
Cat No. S11005

1-9	10+
$6.95	$5.95

- Attractive snap in panel mounting DPST Rocker switch. Connection is by 6mm blade terminals, suitable for crimp connectors.
- Panel cutout 25 x 25mm
- Max panel thickness 3mm
- Switch rating 10A@250VAC.

DRIVE CONNECTOR

3-H Drive "Y" POWER CABLE



P19056 **$5.95**

MOTHERBOARD CONNECTOR

Extension cable P8 P9 180MM in length

P19090 **$19.95**

POWER CABLES

51/4" POWER CABLE

Connecting two 51/4 drives to power supply

P19049..... **$5.95**

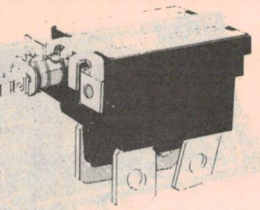
51/4" & 31/2" DRIVE POWER CABLE

Connecting 51/4" & 31/2" drives to power supply

P19055..... **$5.95**

POWER SWITCH

Push on- Push off power switch assembly



- Screw mounted (Ø 3) switch assembly DPST
- Connection is by 6mm Black terminals suitable for crimp connectors
- Mounting centres 20mm
- Switch rating 5A@250VAC
- Suitable for power switches in minitowers and new baby AT casing.

Cat No. S11002

1-9	10+
$7.95	$6.95

SCSI CABLES

50 WAY FLAT RIBBON CABLE

P39400	50 PIN F-F 1 Metre	$29.95
P39410	50 PIN F-F 500MM	$27.95

100 MIXED SCREWS

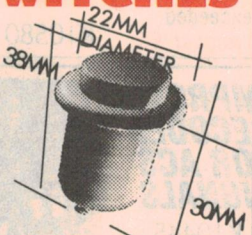
EVERY COMPUTER SERVICEMAN SHOULD HAVE A PACK OF THESE IN HIS TOOL BOX!!

DRIVE SCREWS

H10960	$8.95	Pack of 100
H11234	$1.95	Pack of 4
H11236	$1.95	Pack of 4
H11238	$3.95	Pack of 10
H11240	$2.95	Pack of 8

LARGE SWITCHES

As used in Pinball and Arcade Machines. Ideal for easy identification and use by the disabled and patients in hospitals or the elderly. Comes in bright colours.



10+	1-9	Colour
S11066....	$3.95	
$3.50		RED
S11067....	$3.95	$3.50 GREEN
S11068....	$3.95	$3.50 BLUE
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Construction Project:

MINISPOT 2 AM/FM ALIGNMENT SOURCE

Here's an updated and enhanced design for a very handy little project: a low cost signal source for aligning AM and FM radio IF's. This new version also provides an audio output, for checking amplifiers and other gear.

by JIM ROWE

Back in the February 1981 issue, we described a very small (and inexpensive) 455kHz signal source for AM radio alignment, called the Minispot. It was a very handy little unit, and judging from the reports from PCB suppliers, it was apparently built up by a large number of people.

Lately, though, we've had a number of requests for an updated Minispot — and preferably one that would be suitable for aligning FM radios as well. It seemed a good idea, and after a bit of design work and bench testing, we've been able to come up with this new Minispot Mk2.

The new design provides both a 455kHz signal for aligning AM radio IF strips, and a 10.7MHz signal for doing the same job on FM radios. Both signals are modulated with an audio tone of around 1kHz, at a convenient level of modulation, and as a bonus the 1kHz audio signal is also available by itself for general audio testing. So it's really quite a useful little signal source — especially as it's fully self-contained, in a compact UB-3 size plastic jiffy box. Just the shot for tucking into a corner of your toolbag...

As the circuit uses only two low cost CMOS integrated circuits and a JFET, it draws very little current and can be run very economically from three AA-size 'penlight' cells. It's easy to build, too, as almost all of the parts are mounted on a single small PC board.

How it works

Most of the circuitry is based around a single CMOS chip, a 74HC00 quad NAND gate (U1). Two of the IC's gates (U1c,d) are connected as an audio oscillator, running at a nominal frequency of 1kHz. As the output of the oscillator at pin 8 is a square wave, a simple two-stage passive low pass filter formed by R5/C4 and R6/C5 is used to remove most of the higher-order harmonics, leaving a moderately 'fruity' sinewave. This is fed directly to output selector switch SW1c as the Minispot's audio output, as well as being used to modulate the two high frequency signals.

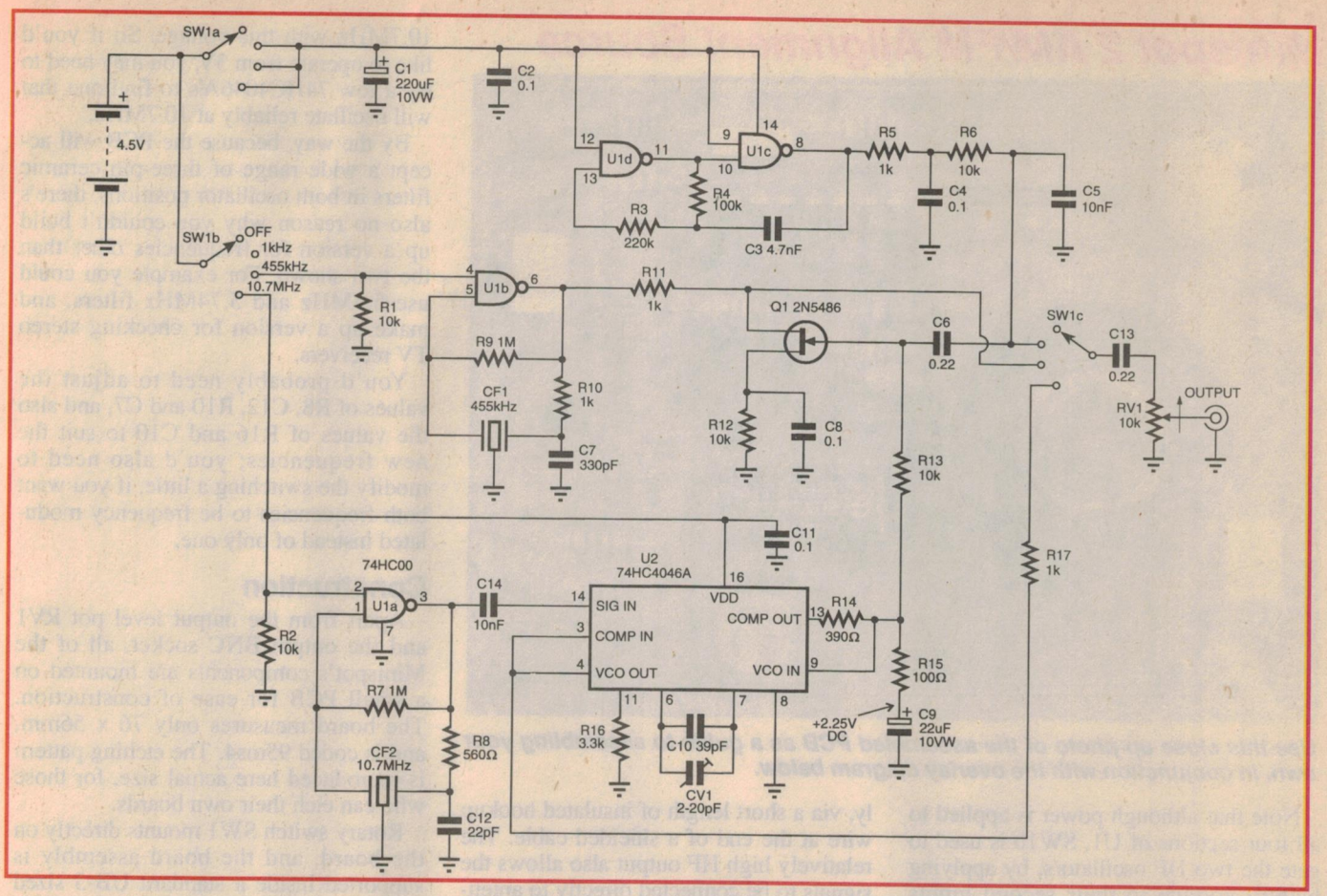
The 455kHz signal is generated by the oscillator around U1b, which uses low-cost ceramic resonator CF1 as the tuned feedback element. The circuit and board are designed to take either the five-pin Murata CFW455E filter available from Dick Smith Electronics, or a three-pin device such as the Murata PFB455J. It would probably also be possible to use the two-pin BFB455 device as sold by Jaycar, but I haven't tried this as yet.

Resistor R9 is used in the oscillator to bias the CMOS gate in its linear region, so that it will provide gain. Resistor R10 and C7 are used as a simple low-pass filter, to ensure that the ceramic filter oscillates on its fundamental rather than an overtone.

The output at pin 6 of the oscillator is a 455kHz square wave signal, unmodulated. To achieve an acceptable level of amplitude modulation, it is passed through a simple 'voltage divider' type modulator using series resistor R11 in conjunction with the drain-source channel of Q1, a 2N5486 low-cost JFET. The 1kHz audio signal is fed via C6 to the gate of Q1, where it is able to vary the FET's channel resistance and hence provide about 30% modulation of the 455kHz signal.

The modulated signal is taken directly to SW1c from the drain of the JFET, as you can see. Resistor R12 and capacitor C8 in the source circuit are used to achieve the most linear modulation from this simple arrangement.

The basic 10.7MHz signal is generated by the oscillator around U1a, which as you can see, is very similar to the 455kHz oscillator. This time CF2 is used to establish the operating frequency, and CF2 is a nominal 10.7MHz ceramic filter. The board will accept a three-pin device, and the circuit has been found to



Although it may look a little complex from the schematic, the Minispot two only uses two low cost CMOS integrated circuits and a JFET to generate either a 1kHz audio tone, a 455kHz AM signal or a 10.7MHz FM signal.

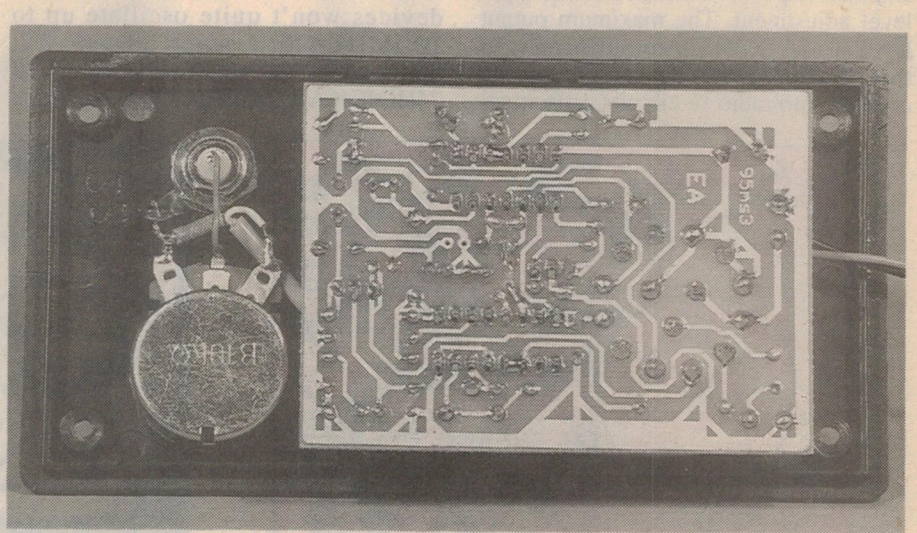
work reliably with a number of Murata filters such as the SFE10.7MH and the SFE10.7MJ.

Again resistor R7 is used to bias the gate in the linear region, while R8 and C12 ensure that the filter operates on its fundamental.

The output from pin 3 of the oscillator is a steady 10.7MHz squarewave, of course, and in order to be useful for FM receiver alignment, it needs to be frequency modulated. This is achieved by feeding the signal to U2, a 74HC4046A phase-locked loop (PLL) device used here as a simple modulator.

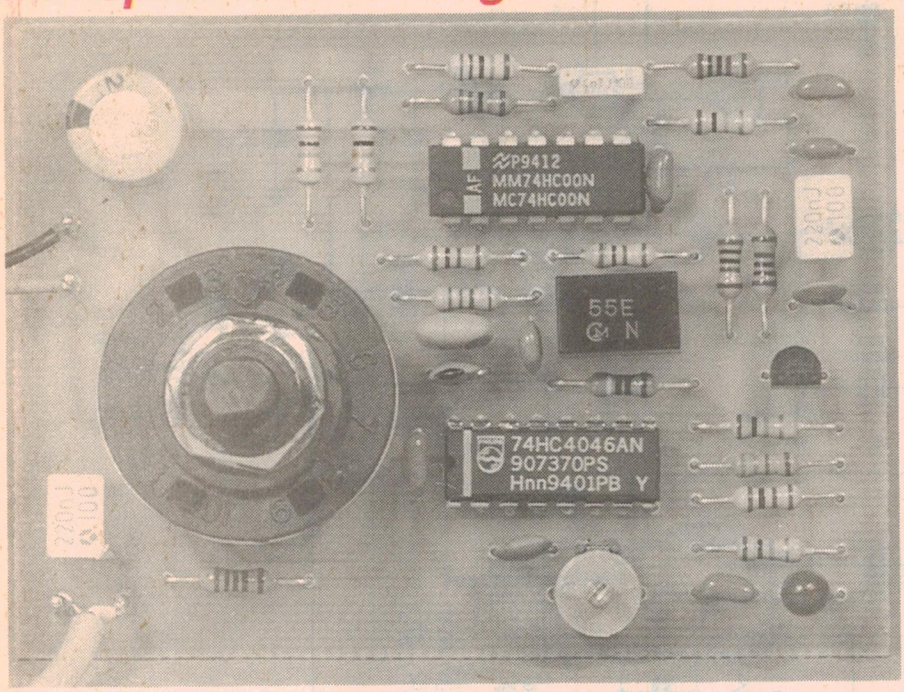
The PLL's internal voltage-controlled oscillator (VCO) is set to operate at 10.7MHz by resistor R16 and capacitor C10 (plus trimmer CV1), so that the basic action of the PLL is to phase lock the VCO to the signal from U1a. However a small amount of the 1kHz audio signal is injected into the loop via R13 and R15, so that the VCO frequency is 'wobbled' either side of 10.7MHz at a 1kHz rate. This gives the desired degree of FM, while still keeping the VCO's centre frequency locked to 10.7MHz. The modulated signal is taken from the VCO output at pin 4 of U2, and fed to output switch SW1c via buffering resistor R17.

As you can see, the three sections of switch SW1 are used to control not only the Minispot's power but also its operating mode. In the fully anti-clockwise position, power is off; the next position applies power to U1, but only enables the 1kHz oscillator; the third position enables the 455kHz oscillator as well; while the fourth and final position enables the 10.7MHz oscillator instead, and also applies power to modulator chip U2.



Most of the parts mount on a small PCB, which is supported on the back of the rotary switch. A short length of shielded wire takes the selected output signal to the output level pot, and then to the output socket.

Minispot 2 AM/FM Alignment Source



Use this close up photo of the assembled PCB as a guide to assembling your own, in conjunction with the overlay diagram below.

Note that although power is applied to all four sections of U1, SW1b is used to gate the two HF oscillators, by applying battery voltage to their second inputs (pins 4 and 2). These pins are normally tied 'low' via R1 and R2, disabling the oscillators unless the pins are pulled 'high' by SW1b. The same switch section is used to apply battery voltage to U2 only when it is needed.

SW1c selects the output signals, as mentioned earlier. The selected signal is fed through DC blocking capacitor C13, and then to pot RV1 which allows output level adjustment. The maximum output level is over 1V RMS for all signals, so that if desired the HF signals can be coupled into radio IF circuits capacitively, via a short length of insulated hookup wire at the end of a shielded cable. The relatively high HF output also allows the signals to be connected directly to antenna terminals, etc., for 'forcing' them through RF stages and converters.

Thanks to the use of 74HCXX CMOS devices, the complete circuit operates very reliably from 4.5V, as provided by three dry cells. Depending on the exact device you use for U2, and its high frequency performance, you *may* also be able to operate it from the 3V from two cells. However some 74HC4046A devices won't quite oscillate up to 10.7MHz with a supply of only 3V; that's why I've specified 4.5V, as all 74HC4046A's should oscillate well past 10.7MHz with this voltage. So if you'd like to operate from 3V, you may need to try a few 74HC4046A's to find one that will oscillate reliably at 10.7MHz.

By the way, because the PCB will accept a wide range of three-pin ceramic filters in both oscillator positions, there's also no reason why you couldn't build up a version for frequencies other than the two shown. For example you could use 5.5MHz and 5.74MHz filters, and make up a version for checking stereo TV receivers.

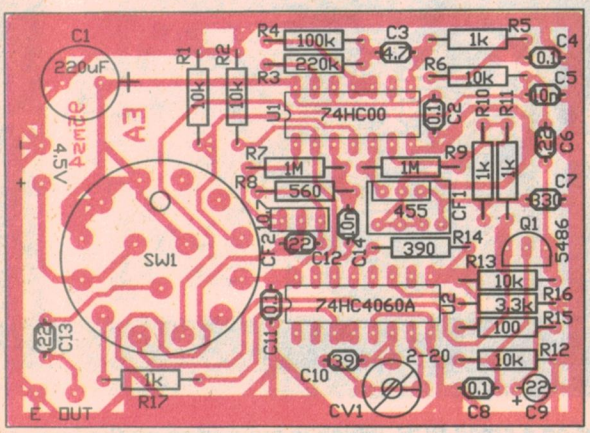
You'd probably need to adjust the values of R8, C12, R10 and C7, and also the values of R16 and C10 to suit the new frequencies; you'd also need to modify the switching a little, if you want both frequencies to be frequency modulated instead of only one.

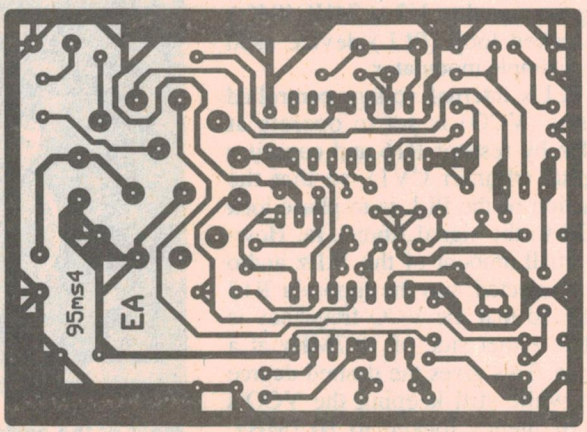
Construction

Apart from the output level pot RV1 and the output BNC socket, all of the Minispot's components are mounted on a small PCB for ease of construction. The board measures only 76 x 56mm, and is coded 95ms4. The etching pattern is reproduced here actual size, for those who can etch their own boards.

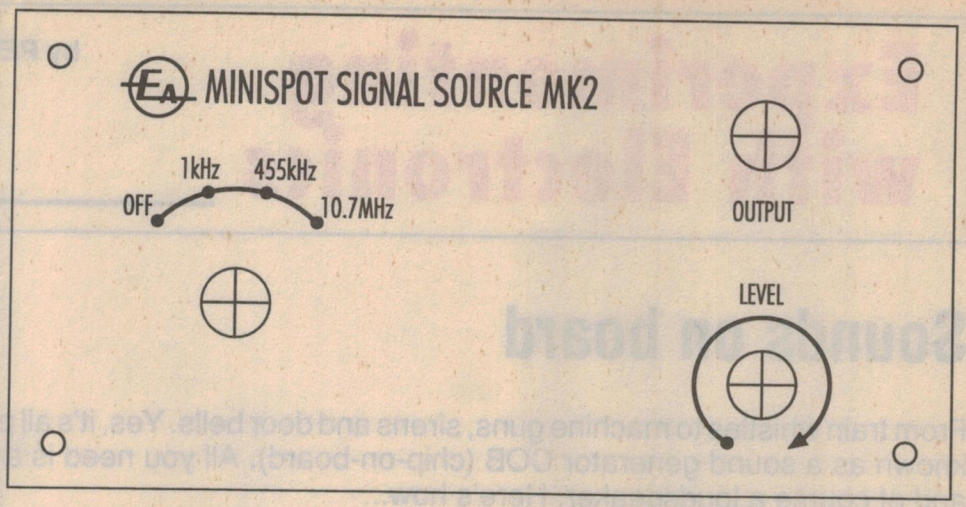
Rotary switch SW1 mounts directly on the board, and the board assembly is supported inside a standard UB-3 sized jiffy box by the switch. The leads of the battery snap connect directly to the PCB via two terminal pins, as does a short length of shielded cable which takes the selected output signal to output level pot RV1. The pot and the output socket mount alongside the PCB, as you can see from the internal photo. Mounting the pot and socket off the board not only makes assembly easier, but also allows you to use a different type of socket if you prefer.

The position and orientation of all of the parts should be clear from the PCB





Left: The overlay diagram, showing in detail where everything goes on the board. Note that either a 5-pin or 3-pin 455kHz ceramic filter can be used in the CF1 position. Right: The PCB pattern, actual size for those who etch their own boards.



Use this artwork to make a replica of our prototype front panel, if you wish. As you'd expect, its reproduced at full size to make the job easier.

photo and the overlay diagram. When you're fitting the components to the board, as usual it's a good idea to start with the low-profile parts like resistors and small capacitors, and leave the larger parts such as the switch until later. I tend to leave the IC's until last of all, to help ensure they aren't damaged electrically while the other parts are being fitted.

As the PCB holes for the rotary switch pins sometimes need to be filed slightly to fit the switch comfortably, you may also want to do this hole preparation before mounting the ceramic filters and ICs. Don't forget to fit the transistor, electrolytic capacitors and ICs the correct way around, as shown on the overlay diagram. The five-pin 455kHz ceramic filter will only fit into the board one way, while the three-pin types are symmetrical and can be fitted either way around.

There don't seem to be any three-cell battery holders available, so for the prototype I used a plastic holder of the type which normally takes four AA-size cells, connected in series and mounted in 'two by two' fashion. To take the place of the missing fourth cell I made up a 'dummy' cell using a small piece of blank PCB laminate, cut to the same overall dimensions as an AA cell, with a 'cap' taken from an old cartridge fuse soldered to each end. This worked out quite well.

Before assembling the completed PCB assembly into the jiffy box, I fitted the box lid with a dress panel made using Dynamark photo-sensitive aluminium. The artwork for the panel is shown here actual size, for those who wish to duplicate it.

Testing & adjustment

There's only one adjustment to be made to the Minispot when it's wired, and this also is easiest done just before the PCB assembly is fitted into the box. It's the adjustment of trimmer cap CV1, which basically sets the VCO of U2 so that it's centred on 10.7MHz for the cleanest FM output.

When the PCB is wired up, then, turn the function switch SW1 to its fully anti-clockwise 'OFF' position and connect the batteries to the board. Then turn the switch clockwise to the first position, and if possible check the output signal at the pins near R17 and C13, either with a scope, a crystal earpiece or a bench amplifier. You should see or hear an audio tone, with a frequency close to 1kHz.

Now switch to the second position, and if you're using a scope you should see a signal of 455kHz, amplitude modulated by about 30 - 40%. You won't be able to check this signal (or the 10.7MHz signal with an earphone or amplifier, but an AM radio placed close by should emit a 1kHz tone if everything in OK.

Finally, switch to the fully clockwise position. The scope should show a 10.7MHz signal, 'wobbling' by about 5% of its period. This time an FM radio placed alongside the board should produce the audio tone, if all is well.

To adjust the trimmer for optimum FM, connect a DVM (set to a voltage range to read around 2.5V) across capacitor C9 with its positive lead to the capacitor's positive side. It should give a reading somewhere between 2V and 3V. Now adjust CV1 with an insulated alignment tool, until the DVN reads 2.25V. This sets the PLL so that 10.7MHz is in the centre of its lock range, and gives the best modulation.

Note that if you're running the Minispot from 3V instead of 4.5V, the trimmer should be set to produce 1.5V across C9 rather than 2.25V. In other words, the idea is to adjust the trimmer for half the supply voltage across C9.

And that's about it. With this adjustment done, you can fit the PCB assembly into the case, connect the PCB output to the output level pot, and screw the case lid together. Your Minispot signal source should then be complete, and ready for use. ❖

PARTS LIST

Resistors

All 1/4W 1% metal film unless specified:

R1,2,6,12,13	10k
R3	220k
R4	100k
R5,10,11,17	1k
R7,9	1M
R8	560 ohms
R14	390 ohms
R15	100 ohms
R16	3.3k
RV1	10k linear pot

Capacitors

C1	220uF 10VW RB electrolytic
C2,4,8,11	0.1uF monolithic ceramic
C3	4.7nF MKT or met. polyester
C5,14	10nF MKT or met. polyester
C6,13	0.22uF MKT plastic
C7	330pF ceramic
C9	22uF 10VW tantalum
C10	39pF NPO ceramic
C12	22pF NPO ceramic
CV1	2-22pF trimmer (green)

Semiconductors

Q1	2N5486 junction FET
U1	74HC00 CMOS quad gate
U2	74HC4046A CMOS PLL

Miscellaneous

CF1	455kHz ceramic resonator
CF2	10.7MHz ceramic resonator
SW1	3 pole 4 position rotary switch

Plastic utility box, UB-3 size (130 x 68 x 41mm); printed circuit board, 76 x 56mm, code 95ms4; BNC socket, single-hole panel mounting; two instrument knobs, one medium and one small; holder for four AA-size cells; scrap of PCB laminate, to make 'dummy cell'; battery snap lead; four PCB terminal pins; short length of light shielded cable; solder, etc.

Experimenting with Electronics

by PETER PHILLIPS

Sounds on board

From train whistles to machine guns, sirens and door bells. Yes, it's all possible with low-cost devices known as a sound generator COB (chip-on-board). All you need is a few other bits and pieces — and of course a loudspeaker. Here's how...

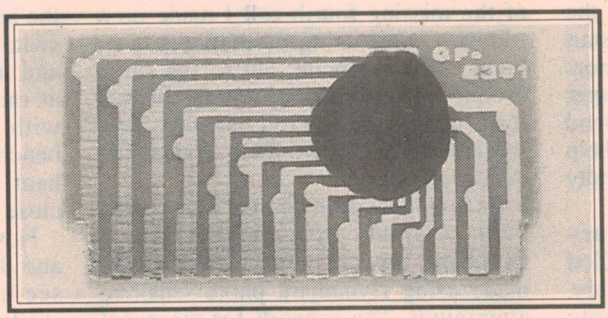
Toys and gadgets that speak, sing and make all kinds of realistic noises have been around for years. Toys of this type used to have an internal tape player with an endless cassette tape, but these days the sounds are stored in a chip, usually in the form of a module called a 'COB' or chip-on-board.

Because they're produced in large quantities, dedicated COBs cost very little, usually less than $5. Their availability is sometimes limited, as they are made for specific industries, not the populace at large. However, this is not a problem with the devices we're describing here.

The sound generator COBs in this article were supplied by DIY Electronics, which also offers a kit of parts for each one. Kit prices range from $5 to $7. The individual COBs are also available from Oatley Electronics, at prices ranging from $2.50 to $3. Supply details are at the end of the article.

Sound generator COBs are basically a pre-programmed ROM with a digital to analog converter which converts the binary sequence stored in the ROM to an analog sound that can be reproduced through a speaker. In most cases, the chip will have a number of sounds, with each accessed using an external pushbutton. All that's needed to make the device work are a few external components, a loudspeaker and a DC supply.

A COB module is simply an IC die bonded to a small printed circuit board and protected by a blob of epoxy, rather than fitted in a conventional IC package. As the photo shows, the COBs we're describing here are fitted to a small PCB that has external edge connections. Unfortunately, the spacing between connector strips is not the standard 0.1" used in the electronics industry.



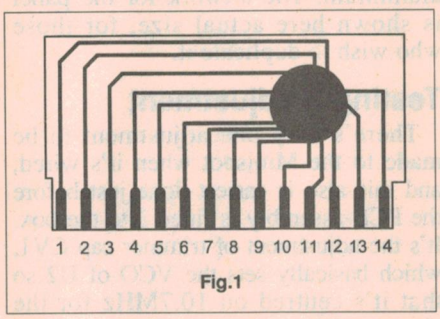


Fig.1

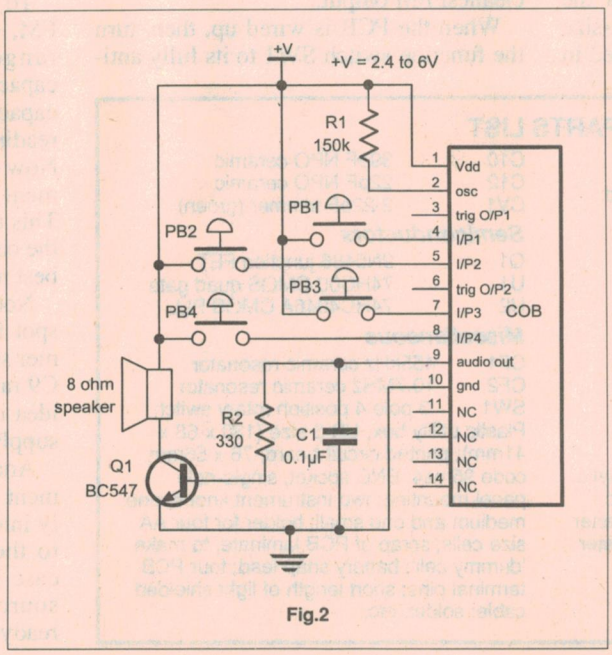


Fig.2

Instead the connector strips are spaced by 2mm, which means you'll have difficulty getting a suitable socket. However, the PCB can be connected via soldered links to strip board or another PCB. All modules have 14 pins, numbered as shown in Fig.1.

So given their low cost, extreme versatility and current availability, it seems appropriate to devote this month's column to sound generating COBs. There are five in the series, and we'll look at each one in turn.

Train sounds

This COB is my favourite, and it will especially appeal to model train enthusiasts. It makes four very realistic sounds: a steam engine chugging along, a level crossing bell, a train whistle blowing three times and the sound of a train crossing a bridge. The circuit diagram is in Fig.2.

The oscillator frequency is set by R1 and the value of the supply voltage, which can range from 2.4V to around 6V. The higher the voltage, the higher the pitch of the sound. With R1 at 150k, the most realistic sounds are with a voltage between three and four volts.

Pressing PB1 starts the steam train whistle. This sound will keep going forever, unless the supply voltage is interrupted or if another button is pressed. If PB2 is pressed, then after three blasts of the whistle, the chugging

sound will take over and last for about five seconds. The whistle sound then resumes.

Pressing PB3 starts the level crossing bell, which also lasts for about five seconds, with the whistle sound taking over. The sound of a train crossing a bridge lasts for 12 seconds, followed by a reappearance of the whistle.

However you can have any sequence, with or without the whistle. For example, pressing (in rapid succession) PB2, 3 and 4 will give the sequence of chugging, level crossing bell and a train crossing a bridge. The inputs are edge triggered and can be pressed at any time.

This module is therefore ideal for model train enthusiasts, as it can be triggered into any sound sequence with switches fitted to the tracks. While the sound level from the circuit as shown is very respectable, a much improved sound quality and volume can be achieved by connecting an audio amplifier to pin 9.

This device has two pulse outputs (pins 3 and 6) which can be used to trigger another COB device. Output trig 1 pulses high when one sound has finished, and output trig 2 pulses high after two sound sequences.

As shown in Fig.3, by connecting either of these outputs to another COB, a more complex sequence of sounds can be arranged. Notice that the audio outputs are joined to drive a common amplifier-speaker system.

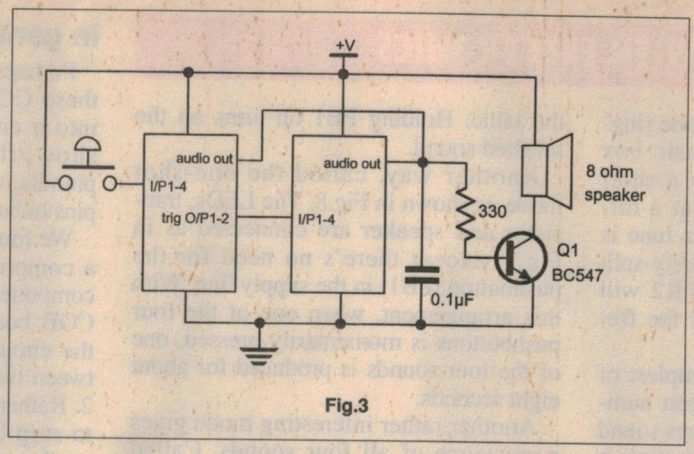


Fig.3

16 door chimes

This sound generator has 16 pre-programmed songs, each lasting about seven seconds. When power is first applied, the chip is reset; momentarily pressing the button causes the first song to play. At the next press, the second song will play; at the third press you get the third song and so on. After the sixteenth press, the cycle repeats. The circuit is in Fig.4.

The tunes range from 'The Farmer in the Dell' to excerpts from 'Swan Lake', and have a music box quality that is clearly but pleasantly electronic. When played through a small eight-ohm speaker, the sound level is surprisingly loud. Connecting the audio output of the COB to an audio system improves the volume, but the distortion becomes more obvious.

The operating voltage is between 2.5 and 5V, and the standby current is around 5uA. Peak operating current is over 200mA. The LED flashes in synchronism with the tune. The idea is to make the LED a visual indicator when the device is used as a doorbell, particularly if the speaker is located out of hearing range.

Ding-Dong

While the 16-song sound generator COB can be used as a doorbell, the classic 'ding-dong' sound is preferred by many. The circuit for this COB is shown in Fig.5. When the button is pressed, the circuit produces two ding-dongs. Because of the Darlington arrangement in the speaker driver, the volume from even a modest speaker is very loud. The audio output of the COB can again be connected to an audioamplifier.

The two RC networks modulate the envelope of the sound, and the component values can be changed to suit. For instance, increasing the value of C1 will increase the duration of the 'ding', while increasing C2 increases the length of the 'dong'. The recommended range of values for C1 and C2 is from 3.3uF to 10uF. The supply voltage is from 2.5V to 4.5V, with 3V typical. The standby current is less than 2uA and the operating current peaks at around 100mA (at 3V).

'Cellular phone'

This COB was developed for toy phones. While it has a number of phone-like sounds, perhaps the most useful is the ring sound. Because the sound emulates a US phone, it could be used as an attention getter without being confused as a phone call. The circuit for this COB is in Fig.6.

There are eight inputs, giving eight separate sounds. The sounds are, from PB1 to PB8: tone 1, tone 2, tone 3, tone

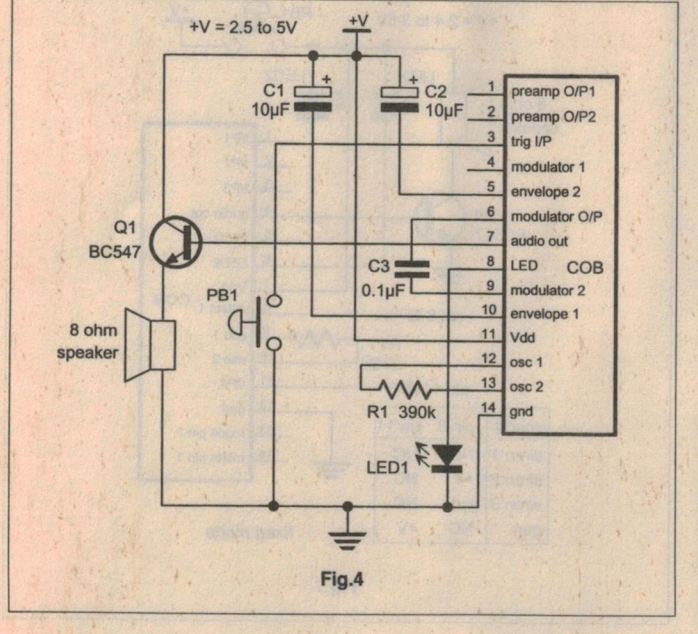


Fig.4

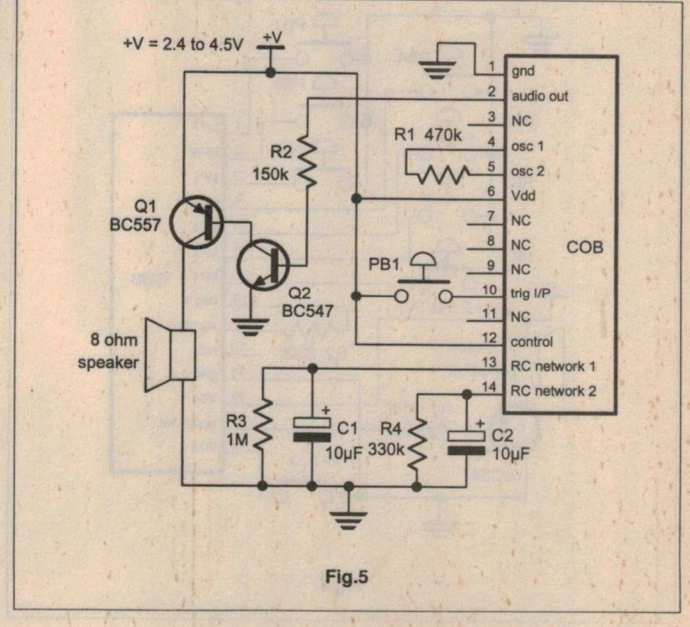


Fig.5

4, DTMF tone sequence, US phone ringing, phone engaged and a music box tune. Tones 1 to 4 are simply a short duration burst of sound, each at a different frequency. The music box tune is London Bridge, played at a lickety-split tempo. Increasing the value of R2 will slow the tempo, but also lower the frequency of the other sounds.

This circuit is perhaps the simplest of all, even though it has the greatest number of pushbuttons. The four tones sound for as long as the appropriate button is pressed. The remaining sounds run through their sequence at each button press, and cycle continuously if the button is held down.

The operating voltage range is from 2.5V to 5V, the quiescent current is 5uA and the peak operating current about 0.2A. The volume from a small speaker, driven as shown in the circuit is quite loud.

Machine gun

This COB is fairly obviously intended for a toy gun. It has four sounds: a machine gun and three sirens. The sirens are all different, although none sound like any of those used in Australia. The machine gun effect is a complex series of sounds, suggestive of a futuristic laser and blaster of alien monsters.

This sound generator can be operated in several ways. The circuit diagram in Fig.7 shows how to connect the COB to get continuous output while the power is applied. The required sound is selected by connecting pins 8 and 11 as shown in the table. Holding PB1 on turns on the selected sound.

Another way, called the one-shot mode, is shown in Fig.8. The LEDs, transistor and speaker are connected as in Fig.7, except there's no need for the pushbutton (PB1) in the supply line. With this arrangement, when one of the four pushbuttons is momentarily pressed, one of the four sounds is produced for about eight seconds.

Another rather interesting mode gives a sequence of all four sounds. Called Mode 2, pins 13 and 14 are connected to the +V rail, with a single pushbutton from pin 3 to ground. While this button is pressed, the generator cycles through all four sounds. Sound stops when the button is released.

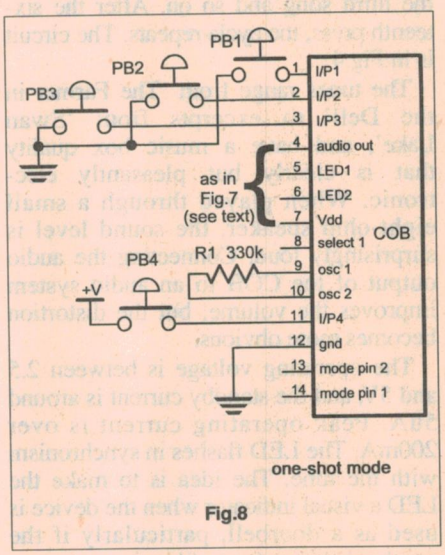


Fig.8

In general

Perhaps the most difficult part of using these COB devices is connecting them into a circuit. As the circuit diagrams show, the COBs all have different pinouts, with some requiring only a few pins to be connected.

We found the easiest construction to be a compromise between mounting some components on, and others external to the COB board itself. For example, most of the circuits require a timing resistor between two inputs, labelled osc 1 and osc 2. Rather than connecting these terminals to strip board and mounting the resistor on the strip board, it's easier to simply mount the resistor on the COB board.

While these devices are designed for toys and similar gadgets, they have lots of other uses. Remember that in all cases the sound level can be substantially increased with an external power amplifier. The sound of a highly amplified machine gun could make an interesting burglar alarm!

Being low cost, they could be used as a simple project in schools or for beginners. All the circuits can operate from 3V, readily available from two D-size cells. However to make soldering less tricky, it might be a good idea to design a PCB to match the edge connectors of the COB.

For those seeking individuality, how about an electronic clock that marks the time of day with a different sound each hour? On a more practical note, you might want a doorbell with a number of speakers placed around the home to make sure it's heard.

There's obviously lots of uses for these fascinating devices, limited only by your imagination. ❖

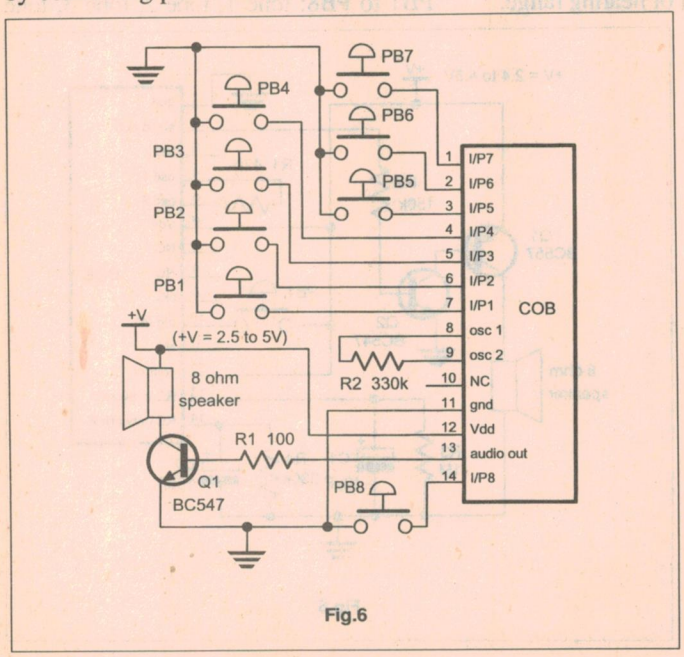
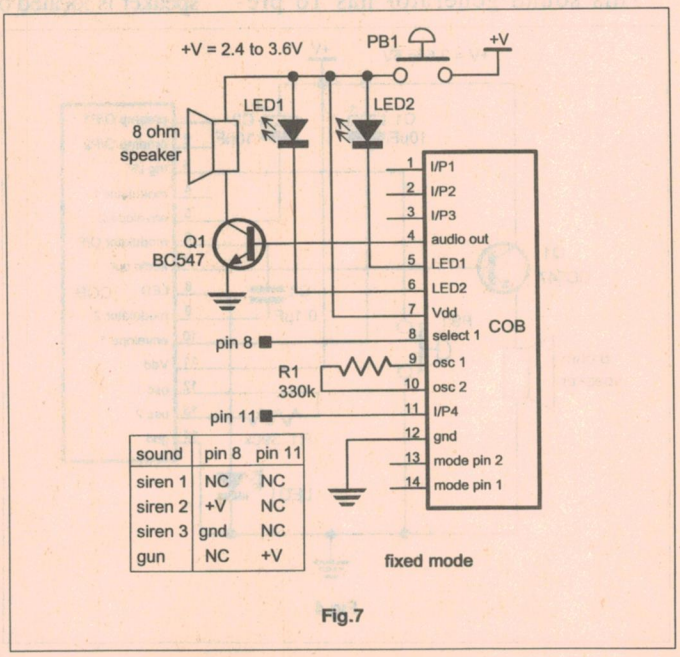


Fig.6



sound	pin 8	pin 11
siren 1	NC	NC
siren 2	+V	NC
siren 3	gnd	NC
gun	NC	+V

Fig.7

For a wider choice of power supplies...

Amtex brings you the world-famous, internationally proven 'Computer Products' range of power supplies – a leader in the field since 1968.

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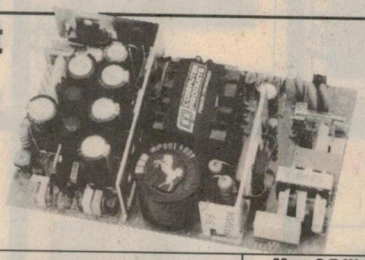
Quality and reliability are outstanding, as all units are made to the most advanced designs, thoroughly computer tested, then individually burnt in.

Here are a few of our most popular models:

Universal Input (90-264VAC) 25W-75W

– MTBF > 100,000 hours
– Single output versions available on NFS40 series



Model	Output Voltage & Max. Current	Max. O/P Watt	
		Free Air	Forced Air
NFS25-7608	+5.1V,2.0A; +12V,1.5A; −12V,0.2A	25W	–
NFS25-7628	+5.1V,2.0A; +12V, 0.2A; −12V,0.2A	25W	–
NFS40-7607	+5.1V,5.0A; +12V,2.0A; −5V, 0.5A	40W	50W
NFS40-7608	+5.1V,5.0A; +12V,2.0A; −12V,0.5A	40W	50W
NFS40-7610	+5.1V,5.0A; +15V,2.0A; −15V,0.5A	40W	50W
NFS40-7628	+5.1V,5.0A; +12V,0.5A; −12V,0.5A	40W	50W
NFS42-7608	+5.1V,3.5A; +12V,2.5A; −12V,0.3A	40W	–
NFS42-7610	+5.1V,3.5A; +15V,2.0A; −15V,0.3A	40W	–
NFS42-7627	+5.1V,3.5A; +24V,1.2A; −12V,0.3A	40W	–
NFS50-7608	+5.1V,7.0A; +12V,2.5A; −12V,0.7A	50W	60W
NFS75-7608	+5.0V,5.0A; +12V,3.0A; −12V,1.0A	75W	–

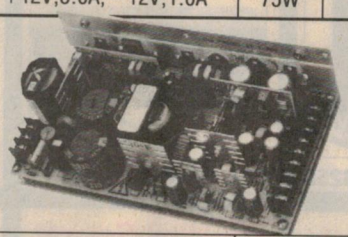
DC-DC Converter

(S) = Single output
(D) = Dual output
(T) = Triple output

Series	Input Voltage	Output Voltage	Max Output Power	Size L x W x H mm
PM600	5V; 12V	5V,0.1A/12V,0.08A(S)	1W	32 x 20 x 10
PM600	5V; 12V	±12V,.04A/±15V,.033A(D)	1W	32 x 20 x 10
A	5v; 12V; 24V; 48V	±12V,0.15A/±15V,0.15A(D)	4.5W	51 x 51 x 10
F	5V; 12V; 48V	5V,1A/12V,0.5A/15V,0.35A(S)	6W	51 x 51 x 10
AFC5	5V; 12V;	5V,1A/12V,0.4A/15V,0.35A(S)	5W	51 x 26 x 10
AFC5	5V; 12V	±12V,0.15A/±15V,0.15A/(D)	5W	51 x 26 x 10
PM900	5V; 12V; 24V; 48V	5V,1A/±12V,0.23A	5.5W	51 x 51 x 10
PM900	5V; 12V;	15V,0.4A/±15V,0.19A	6W	51 x 51 x 10
NFC40	24V; 48V	5V,8A/12V,3.5A/15V,2.8A(S)	40W	56 x 56 x 21
NFC40	24V; 48V	5V,7.5A; ±12V,0.75A(T)	40W	56 x 56 x 21
NFC40	24V; 48V	5V,7.5A; ±15V,0.75A(T)	40W	56 x 56 x 21

Universal Input (90-264VAC) 80W-350W

– MTBF > 65,000 hours
– Single output versions available on NFS110 series

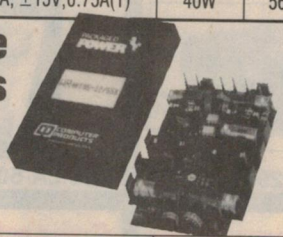


Model	Output Voltage & Max. Current	Max. O/P Watt	
		Free Air	Forced Air
NFS80-7602	+5.0V,12A; +24V,2.5A; +12V,3A; −12V,3A	80W	110W
NFS80-7606	+5.0V,12A; +24V,2.5A; +15V,3A; −15V,3A	80W	110W
NFS110-7601P	+5.1V,10A; +12V,5.0A; −12V,1A; −5.0V,1A	80W	110W
NFS110-7602P	+5.1V,10A; +24V,4.5A; +12V,5A; −12V,1A	80W	110W
NFS110-7604P	+5.1V,10A; +15V,5.0A; −15V,1A; −5.0V,1A	80W	110W
NFS200-7601	+5.1V,30A; +12V,8.0A; −12V,4A; −5.2V,6A	–	200W
NFS200-7602	+5.1V,30A; +12V,8.0A; −12V,4A; 24V,3A	–	200W
NFS200-7603	+5.1V,30A; +12V,8.0A; −12V,4A; 12V,4A	–	200W
NFS200-7608	+5.1V,30A; +12V,8.0A; −12V,4A	–	200W
NFS350-7608	+5.1V,50A; +12V,12A; −12V,5A	–	350W
NFS350-7625	+5.1V,50A; +12V,12A; −12V,5A; (Note 1)	–	350W
NFS350-7626	+5.1V,50A; +12V,12A; −12V,5A; (Note 2)	–	350W

Note 1: 4th floating output is adjustable 4.5V-16.5V, 4A
Note 2: 4th floating output is adjustable 15V-30V, 4A
*Absence of "+" or "−" indicates a floating output

Wide Input Range DC-DC Converters

(S) = Single output
(D) = Dual output
(T) = Triple output



Series	Input Voltage	Output Voltage	Max Output Power	Size L x W x H mm
DR	18-36V	5V,0.5A/12V,0.25A(S)	2.5W	32 x 20 x 13
DR	18-36V; 36-72V	±12V,0.125A/±15V,0.1A(D)	3W	32 x 20 x 13
FW	36-72V	5V,1.5A/12V,0.625A(S)	7.5W	51 x 51 x 10
FW	36-72V	±12V,0.315A/±15V,0.25A(D)	7.5W	51 x 51 x 10
NFC15	20-72V	5V,3A/12V,1.25A/15V,1A(S)	15W	51 x 41 x 12
NFC15	20-72V	±12V,0.625A/±15V,0.5A(D)	15W	51 x 41 x 12
ES	18-36V; 36-72V	+5V,1.5A; ±12V,0.31A(T)	15W	76 x 66 x 21
ES	18-36V; 36-72V	+5V,1.5A; ±15V,0.25A(T)	15W	76 x 66 x 21
NFC25	36-72V	+5V,5A; ±12V,1.0A(T)	25W	76 x 76 x 10
NFC25	36-72V	+5V,5A; ±15V,0.8A(T)	25W	76 x 76 x 10
WRU	36-72V	+5V,5A/12V,2.5A/15V,2A(S)	30W	116 x 66 x 21
WRU	18-36V; 36-72V	±12V,1.25A/±15V,1A(D)	30W	116 x 66 x 21
WRK	18-36V; 36-72V	5V,10A/12V,5A(S)	60W	140 x 99 x 23
WRK	18-36V; 36-72V	+5V,5A; ±12V,1.25A(T)	55W	140 x 99 x 23
WRK	18-36V	+5V,5A/±15V,1A(T)	55W	140 x 99 x 23

Call us now for full technical specifications and any assistance you might need.

COMPUTER PRODUCTS™

AMTEX ELECTRONICS

13 Avon Road, North Ryde 2113
Postal Address:
PO Box 285, Chatswood 2057
Australia
Telephone: (02) 805 0844
Facsimile: (02) 805 0750

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APRIL SPECIALS FROM JAYCAR

4 In 1 Solar Construction Kit

Cat. KJ-6770 $17.95

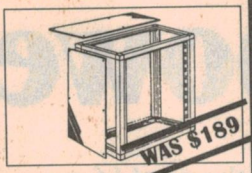
Night PIR Light

Cat. LA-5008 $19.95

Window Alarm

Cat. LA-5095 $12.95

18 Unit Rack Frame



Cat. HR-5220 $129

Car Xover 3 Way 150Hz 10kHz

Cat. CX-2632 $29.95

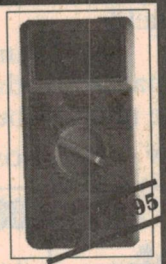
Digital Thermometer

Cat. QM-6300 $10.00

LCR Print Indicator Kit

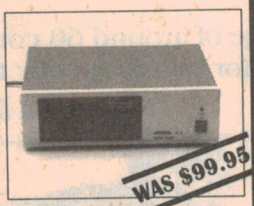
Cat. KC-5145 $49.50

DMM Cap Freq Trans 20 A



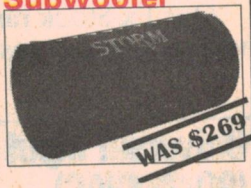
Cat. QM-1310 $59.95

AM/FM Tuner



Cat. AR-2250 $69.95

Storm Car Subwoofer



Cat. CS-2295 $199

Wirewound Resistor Pack

Cat. RR-3200 $10

1.1A Ni-MH AA Battery

Cat. SB-2455 $5.95

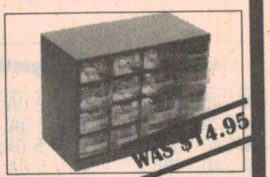
12-240V 200W Inverter Kit

Cat. KC-5154 $159

Plastic Box 190x110x60mm

Cat. HB-5504 $5

16 Drawer Parts Case



Cat. HB-6320 $12.95

Bass Cannon & Satellite Spkrs

Cat. CS-2296 $249

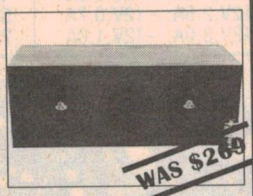
Bellmate 100 PIR

Cat. LA-5017 $20

Bookshelf Rear Speakers

Cat. CS-2430 $250

Centre Speaker



Cat. CS-2432 $219

6" Response 4/8Ω Speaker

Cat. CW-2140 $59.50

US Phone Plugs

6 position 4 contact - Pkt 5
*Not Austel approved

Cat. PP-1432 $0.50

Supercharged MS-DOS

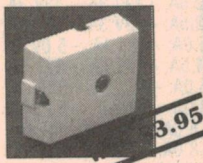
Cat. BM-2144 $4.00

T15 Torx Screwdriver

Cat. TD-2035 $2.00

US Wall Socket

*Not Austel approved



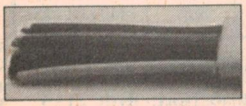
Cat. YT-6058 $1.00

8" Response 4/8Ω Speaker

Cat. CW-2142 $90.00

Phone Cable

*Not Austel approved



4 core Cat. WB-1602
$0.50/m $29/roll
6 core Cat. WB-1603
$0.65/m $41/roll

Solder Station

Cat. TS-1200 $35

US Lead

Plug to plug - 3 metres
*Not Austel approved

Cat. YT-6080 $0.50

Video Dubbing Kit

Cat. AV-6540 $20.00

12" Response 4/8Ω Speaker

Cat. CW-2145 $179

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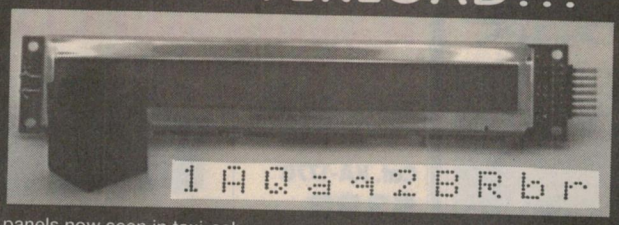
INFORMATION OVERLOAD!!!

40 CHARACTER / 2 LINE, 5 X 7 DOT MATRIX LCD DISPLAY BARGAIN!



Yes, another Jaycar scoop purchase where you reap the benefit. This time its a quality, Seiko brand (Japanese made) 2 line readout module similar to the "dispatcher" panels now seen in taxi-cabs.

The panel has a built-in character generator ROM/RAM, 192 (yes 192!) character types, single +5V supply, 80 x 8 bit display area and electroluminescent display backlight illumination for night viewing! The display is so intelligent it only requires drive from 4 or 8 bit micros. Individual character height is a healthy 5h x 3w(mm) approx. Easy viewing from up to two metres away - wide angle OK.

NEW

Learn display technology while you have fun!

Each module comes with an easy to read 32 page instruction manual. This gives full technical information on the unit, including interfacing and drive data. You can program the display to readout in virtually any symbol within the 5 x 7 (+ cursor) format. (The character generator ROM generates 192 standard fonts, the character generator RAM gives you this flexibility).

You would expect to pay $60 plus in large quantities for such a piece of technology, so why are we so excited about this?

There is a downside. The displays are not brand new. They have been carefully removed from recent equipment by skilled technicians and are totally undamaged. The reason why they were removed was to make way for even larger information displays. There is nothing wrong with the displays that we offer you - they are simply the victim of relentless technology. They have not even done a lot of work. We guarantee that each unit is fully operational and within specs at the time of sale.

Yes, and there is more!

The display will work fine in daylight or in an illuminated indoor situation. They really come into their own, however, when they are lit up at night by the Electroluminescent Lamp (EL) panels built into the units! This makes them ideal for mobile use!

In order to do this, you need a DC to AC 115V 400Hz inverter/generator. Boy that sure sounds expensive! Well, yes it is, but not for you!!

Included in the cost of the panel, and the massive technical manual we will provide AT NO EXTRA COST, is a US made EL panel driver inverter! They work at the same +5V supply as the panel! Sure, they are used also but they are in brand new condition as well. Naturally we provide full technical info on this part as well. (It only has 3 connections; "input", "output", "common earth").

Let's summarize what you get: •80 characters (2 line x 40 character) LCD wide angle LCD display with built-in surface mount electronics and stainless steel bezel. Standard 0.1" PCB launcher connection (new condition, but removed from equipment). •massive data manual which includes info on our EL driver module (don't ask for any more info - there isn't any)! New stock. •32 x 23 x 21mm, US made EL panel driver module. (new condition, but removed from equipment).

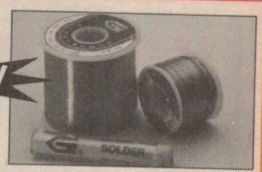
You would expect to pay over $80 plus for this in OEM quantities, heaven knows one-off if you could get them to sell you one! In typical fashion, however JAYCAR has screwed the source down so that their loss is your gain!!! You can have a great time playing with one of these at the fantastically low price of $19.95.

As usual with things like this, quantities are strictly limited so get in early! They do work well but if you need a spare, buy 2 now!! They won't be around next year. We repeat, the goods are not new but they may as well be. They have suffered no deterioration in service except for a bit of solder on some of the leads.

Cat. ZK-8920 **$19.95**

SAVE ON SOLDER

NEW



200 GRAM REELS

0.71mm diameter
Cat. NS-3005 was $7.95 **$6.95**

1.0mm diameter
Cat. NS-3010 was $7.25 **$6.50**

1 KILOGRAM REELS

0.71mm diameter
Cat. NS-3002 NEW **$29.95**

1.0mm diameter
Cat. NS-3015 **$27.95**

HOBBY PACK CANISTERS

0.71mm diameter
Cat. NS-3008 NEW **$1.50**

1.0mm diameter
Cat. NS-3013 **$1.50**

AMMONIUM PERSULPHATE 2.5KG BUCKET

Cat. NC-4256
$29.95 each

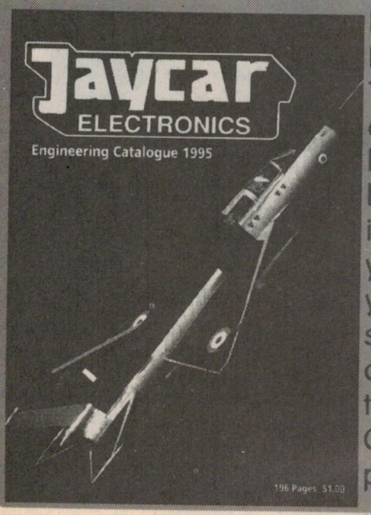
12V NICAD BATTERY CHARGER GIVEAWAY

These are in our catalogue at $17.50. We have found that many of these have a problem with them where the LED won't light, or one of the charging bays doesn't work. So, we are offering these at below cost. You can now buy 2 for less than the price of one, and charge 6 batteries at a time! Note: As the price is so low, they are being sold as is - NO RETURN / NO WARRANTY.

SAVE $$$

Cat. MB-3514 **only $7.50 each**
was $17.50 save $10 on each one

JAYCAR WHOLESALE (02) 743-5222



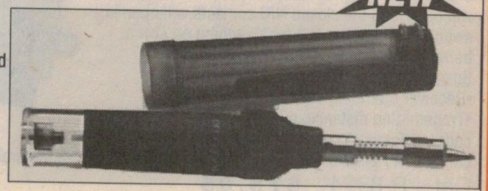
NEW CATALOGUE LAST MONTH

The Jaycar 1995 196 page catalogue was released last month. It includes hunderds of new and interesting products. If you haven't got your copy yet call into any Jaycar store or dealer and pick one up for $1, or send $2 to Jaycar, PO Box 185 Concord. 2137, and we'll post you one.

NEW MODEL HOT SOL GAS SOLDERING IRON

NEW

The new one is smaller than our previous model and has been further refined. See our catalogue for full details.



Cat. TS-1700 **$32.95**

SERVICE KIT WITH CASE AND OTHER TIPS $49.95 CAT TS-1702

BULK USERS - CONTACT OUR WHOLESALE DEPARTMENT FOR SPECIAL PRICING (02) 743 5222

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NEW KITS

Mini Spot AM/FM Alignment - Source Kit

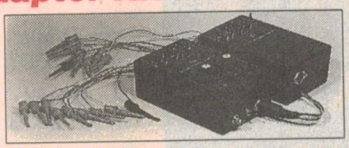
NEW

REF: EA 4/95

This kit will provide both a 455kHz signal for aligning AM radio IF strips and a 10.7MHz signal for doing the same job on FM radios. Both signals are modulated with an audio tone of around 1kHz, with the 1kHz audio signal available by itself for audio testing. The Jaycar kit is complete with PCB, case, silk screened front panel, plus all electronic components. Three AA penlight batteries required. Use Cat. SB-2354 Pk4

Cat. KA-1796 **$23.95**

Digital Trigger Adaptor Kit For CRO's



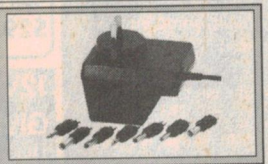
REF: EA 4/95

This project allows you to use your CRO more effectively with digital circuits by allowing you to monitor any given event in the circuit under test, and to trigger the scope only when all the relevant input conditions are met. With eight inputs (expandable to 24), it also includes an adjustable trigger delay, so it can effectively convert your scope into a low cost logic analyser. Kit is complete with PCB, case, screen printed front panel, IC test clips plus all electronic components.

NEW

Cat. KA-1772 **$55.00**

1 AMP PLUG PACK BARGAIN



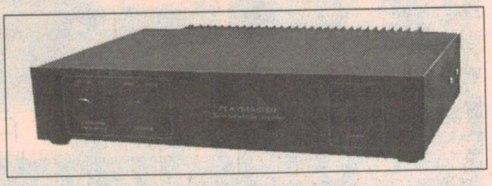
A 1 amp switchable plugpack is now available. 240V primary to 3v, 4.5v, 6v, 7.5v, 9v and 12vdc at 1 amp. Amazing price.

Cat. MP-3016 **only $29.95**

NEW KITS

Playmaster 300W Subwoofer Amp Kit

NEW



REF: ELECTRONICS AUST APRIL / MAY 1995

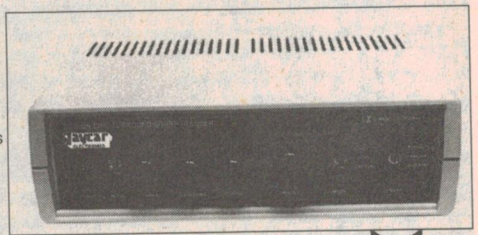
Cat. KA-1770 **$399**

Dolby Pro Logic Surround Sound Kit

REF: SILICON CHIP DEC 94 / JAN 95

DOLBY SURROUND PRO • LOGIC

Short Form Kit



This kit is supplied with pre-tinned PCB, Dolby ICs and all electronic components as per the Silicon Chip article, RCA socket bank, potentiometers, switches and internal audio and mains cable. The short form version of the kit is ideal for those constructors who wish to build a complete decoder with amplifier modules in the same case as the decoder (see the 'Boxes/racks' section).

NEW

Cat. KC-5175 **$169.50**

Enclosure Kit

This includes the low radiation toroidal transformer, mains lead and plug, fuse holder and fuse, mains switch, black anodised brushed aluminium instrument knobs, professionally punched and screened front panel, punched rear panel plus all mounting hardware.

Cat. KC-5176 **$69.50**

NEW JAYCAR STORE FOR NEWCASTLE

NOW OPEN

830 HUNTER ST. NEWCASTLE.
PH 653 799 FAX 653 796

REMOTE CONTROL SWITCHES

LATCHING UNIT:

NEW

This unit has both Normally Open and Normally Closed contacts. When ON is pressed the N/O relay contacts will close and stay closed. The N/C contacts will open and stay open ie: switch the unit on. When OFF is pressed the closed N/O contacts will open, and the closed N/C contacts will open ie: switch the unit off. Ideal for switching on / off a home burglar alarm, house appliances etc.

Specifications:

•Receiver operating voltage: 11 to 15VDC •Transmitting distance: over 50 metres •Security code - DIP switch: user programmable •Relay contact:1A / 24VDC •Receiver contacts: N/O and N/C •2 transmitters and 1 receiver supplied

Cat. LR-8824 **$79.95** Spare transmitters Cat. LR-8825 **$23.95**

MOMENTARY UNIT:

This unit has two relays in the receiver. Both relays can be wired in either Normally Open or Normally Closed contacts wiring configurations. When the ON button is pressed Relay 1 will change over for one second. When the OFF button is pressed Relay 2 will change over for one second. Both buttons are momentary types. This unit can be wired to work switching both on and off either a normally open or a normally closed contact. Ideal for car central locking, car alarms, switch logic circuits, remote paging using 2 different buzzers etc etc.

Specifications: •R'cver operating voltage: 11- 15VDC •Transmitting distance: over 50 metres •Security code: DIP switch: user programmable •Relay contact: 5A / 120V

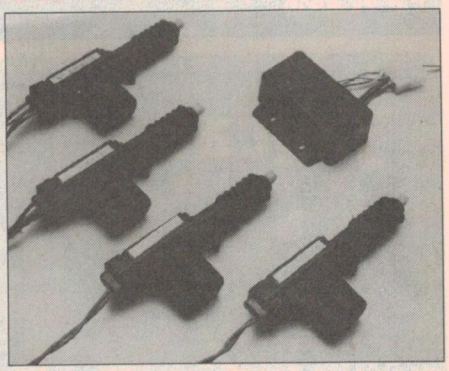
2 transmitters and 1 receiver supplied

Cat. LR-8826 **$99.95**

NEW

Spare transmitter Cat. LR-8827 **$23.95**

4 Door Car Power Door Lock Kit



If you own a 4 door car and want the convenience of power door locking, this is the kit for you. It consists of 2 master solenoids and 2 remote solenoids.

Suitable for connection to car alarms with negative triggering central door locking output. Full wiring harness to connect all 4 solenoids to the doors of even the biggest cars, all hardware.

Cat. LR-8830 **WAS $119.50** **$95.00**

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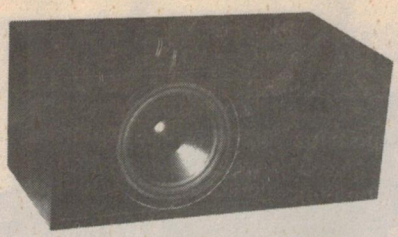
Jaycar vifa JV80 8" Subwoofer Kit

NEW



Refer: Electronics Australia April 1995.
Amazing bass from such a small enclosure! This subwoofer uses one of Vifas new long stroke, low reflection magnesium basket woofers. The driver has an impedance of 6 ohms, so could also be used in a car situation. The power handling is very large, for such a small driver being 150 watts nominal (RMS) a long term max rating of 300 watts (on for one minute, pause for two minutes) and a short term max power of 500 watts (on for one second, pause for one minute). We also recommend you use a polyswitch RXE300 Cat RN3472 $10.95.
The enclosure is very small with a volume of 35 litres and only 600 x 270 x 300(D)mm. The cabinet is supplied prebuilt and is made from MDF in blackwood veneer. Grill is supplied with speaker cloth mounted.

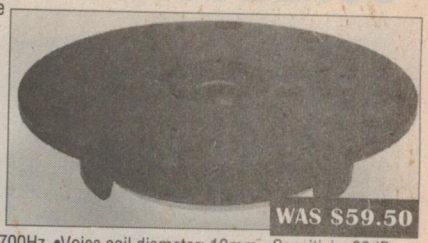
SPEAKER
Cat. CW-2115 — $199.50 ea

POLYSWITCH SPEAKER PROTECTOR
Cat. RN-3472 — $10.95 ea

CABINET - PRE BUILT
Cat. CS-2540 — $139.00 ea

TOTAL: $349.45 ea

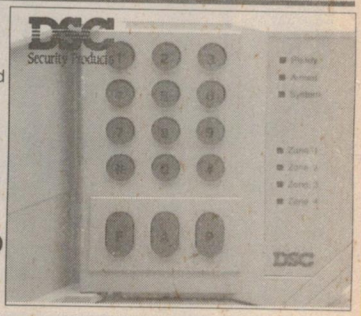
vifa D19 Tweeter



D19 is a 19mm dome tweeter with polymer high loss diaphragm. Very smooth and versatile, and offers excellent dispersion. Ferrofluid cooled voice coil ensure high power handling and perfect damping. Suitable for any 2, 3 and 4 way systems with power handling up to 100 WRMS.
Specifications:
•System power: 100wrms •Freq range: 3hz to 20kHz •Resonance: 1700Hz •Voice coil diameter: 19mm •Sensitiviy: 89dB 1w/m •Nom impedance: 8 ohm •Suggested crossover point: 5kHz

Cat. CT-2019 — **$39.50**

4 Zone Digital Home Alarm With Dialler



The alarm is made by DSC in Canada, and features an Austel approved digital telephone dialler which has the ability to ring a friend, neighbour or a security monitoring company when triggered. For full specifications and features see our new 1995 catalogue on page 69.

Cat. LA-5350 — **$279.00**

•Backup battery and mains adaptor extra.

Shielded Speakers

Shielded speakers are designed to be used near televisions and computer monitors. Normal speakers effect the picture by distorting it due to the speakers magnetic field. Shielded speakers have a second magnet mounted on the back of the first magnet. This extra magnet does not effect the performance at all, and these speakers can be used in place of a non shielded tweeter without compromise. The cost difference of the extra magnet is minimal.

Shielded Dome Tweeter

NEW

This tweeter represents very good value for money it has a very good high frequency response extending right up to 20000hz .It features a light dome made of mylar and a frequency dispersion plug. It makes a perfect companion to our 120mm magnetically shielded speaker.
SPECIFICATIONS. •System power: 80 watts •Freq. Range: 3000 - 20000 hz •Resonance: 2350 hz •Sensitivity: 94db 1W/1M •Nom Imp: 8 ohms. •Suggested crossover point 5000 hz.

Cat. CT-2006 $16.95

5" Shielded Woofer

NEW

This quality driver has a black poly cone with a rubber surround. Applications would include replacement in large televisions, or as the basis of a low cost, good sounding, centre channel speaker. This speaker also has two 8 ohm voice coils which means impedance is very versatile best performance is at 16 ohms.

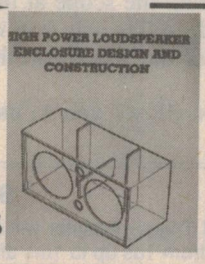
LOW COST CENTRE SPEAKER SYSTEM
Use two CW-2102 woofers, one CT-2006 tweeter and a CX-2613 crossover to give a very reasonable sounding centre speaker at a fraction of the price of built units. Mount these in a sealed box of 18 litres. Inside cabinet dimensions: Width 410mm, Height 150mm and Depth 300mm.
You build the cabinet, and the speakers and crossover are only $105.35 for the 4 units. See catalogue for full specifications.

Cat. CW-2102 — $39.95

High Power Loudspeaker Enclosure Design And Construction Book

NEW

The designs in this book are applicable for all types of high power sound reinforcement and musical instrument amplification systems. The information given will enable sound systems from fifty to several thousand watts to be correctly made and installed. The first part of the book is a comprehensive technical section covering much of the theory of selecting and matching loudspeaker components, electrical connections, crossover design and use, with details of materials and methods of construction. 30 designs shown in an easy to follow constructional drawings with technical specification data. The recommended drivers are English. Softcover - 165 pages - 292 x 207mm



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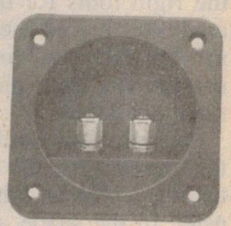

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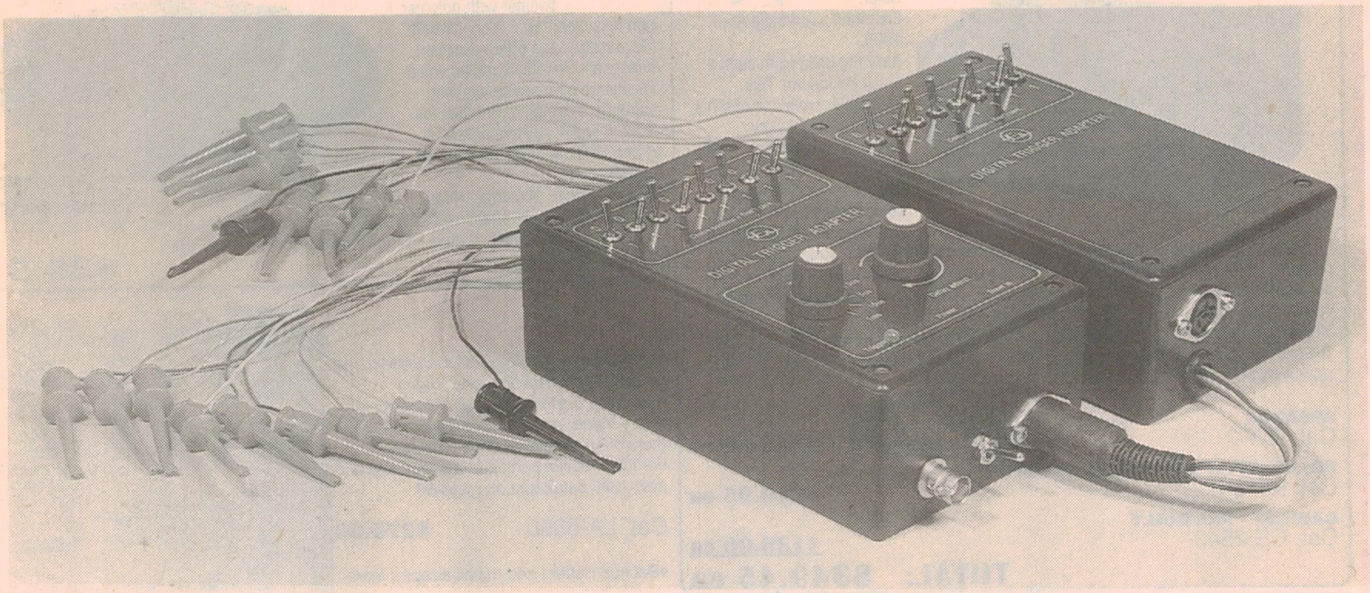


DIGITAL TRIGGER ADAPTER FOR SCOPES

With eight inputs (expandable to 24), this useful device will monitor almost any digital circuit and trigger your oscilloscope only when a preset combination of inputs is found. It also includes an adjustable triggering delay, so it can effectively convert your scope into a low cost logic analyser.

by GRAHAM CATTLEY

Faultfinding in digital equipment can be very difficult if you don't have the right tools for the job. With logic analysers priced well out of reach of most hobbyists, an oscilloscope is usually the only piece of test equipment available.

One problem with oscilloscopes is that they are usually designed for use in analog circuitry, where you are interested in the shape, amplitude and frequency of the incoming waveform. This is not so much the case in digital electronics, where the emphasis is more on the timing of a signal and the conditions leading up to a specific event.

Using an oscilloscope to monitor a line in a digital circuit is all very well, but when a particular signal is multiplexed along with a lot of other signals, life gets rather complicated. Using an oscilloscope to look at the relevant part of such a waveform — or even trying to *find* the relevant part of the waveform — can be very difficult. In order to get a meaningful display on the scope, a way of triggering the scope at the right time is needed. In this way you will get only the part of the waveform that you want to see.

This project allows you to use your oscilloscope more effectively with digital circuits by allowing you to monitor any given event in the circuit under test, and to trigger the scope only when all of the relevant input conditions are met.

SPECIFICATIONS

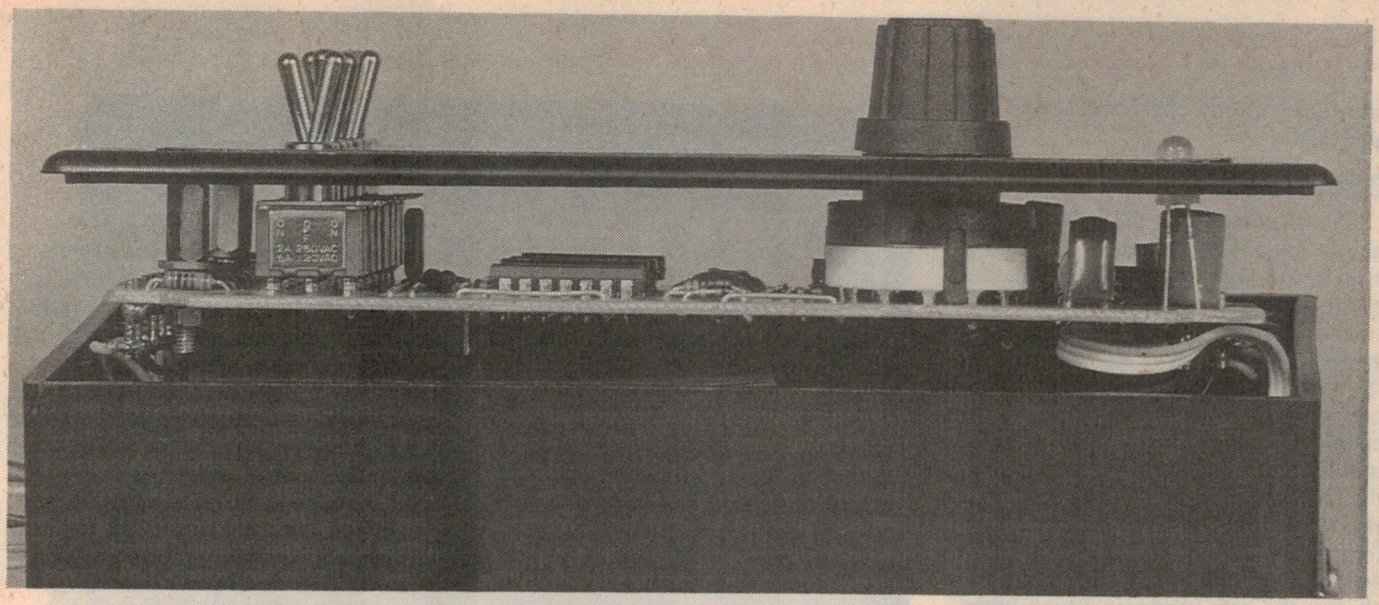
The Digital Trigger Adapter will operate at frequencies up to 12MHz and can delay the trigger pulse from 1us up to 1ms after the preselected event has occurred.

You may wonder why a minimum delay of 1us has been chosen, as this will limit the unit to an upper frequency of 1MHz — if the period of the incoming signal is less than that of the delay, then the unit will be constantly retriggered before it has a chance to time out and produce a trigger pulse for the oscilloscope.

The reason for such a relatively long minimum delay is because you don't really *NEED* to delay a signal running higher than 500kHz. Most scopes have a minimum sweep rate of 0.2us/div — which means that any signal running at a frequency higher than 500kHz (1 divided by 10 x 0.2us), will have more than one complete cycle on the screen, and thus it does not need to be delayed.

Note that the DTA has an inherent delay of 40ns due to the propagation delays of the four ICs in the signal path, and while this can be safely ignored in most applications, it should be taken into account when working with high-speed digital equipment.

The basic DTA has eight inputs. It is, however, very easy to add up to two additional slave units to give a total of 24 inputs — useful for decoding memory addresses.



The mounting screws and spacers are clearly visible in this side view of the master unit. Slave units are mounted in a similar manner, with an extra screw and spacer in place of the rotary switch.

How it's used

So how do you specify the input conditions for the event you want to observe? Simple; on the front panel of the Digital Trigger Adapter (DTA) there are eight three-position switches. These allow you to 'program' the combination of highs and lows required on the eight inputs in order to produce a trigger pulse for the oscilloscope. By connecting these inputs to the circuit under test, it is possible to trigger the scope only when required.

Take for an example, the case of a multiplexed numeric display. Here the data for all the same segments of each display is on the one line. Using a conventional oscilloscope to monitor this line would not give you any relevant information, as you couldn't tell which display was being turned on at any given time.

By connecting one of the input lines of the DTA to the common pin of one of the 7 segment displays, and setting the corresponding input switch to '0' (for a common cathode display), the scope will trigger only when that particular display is active. You can now use the scope to look at any of the segment lines and see only the signals going to that display.

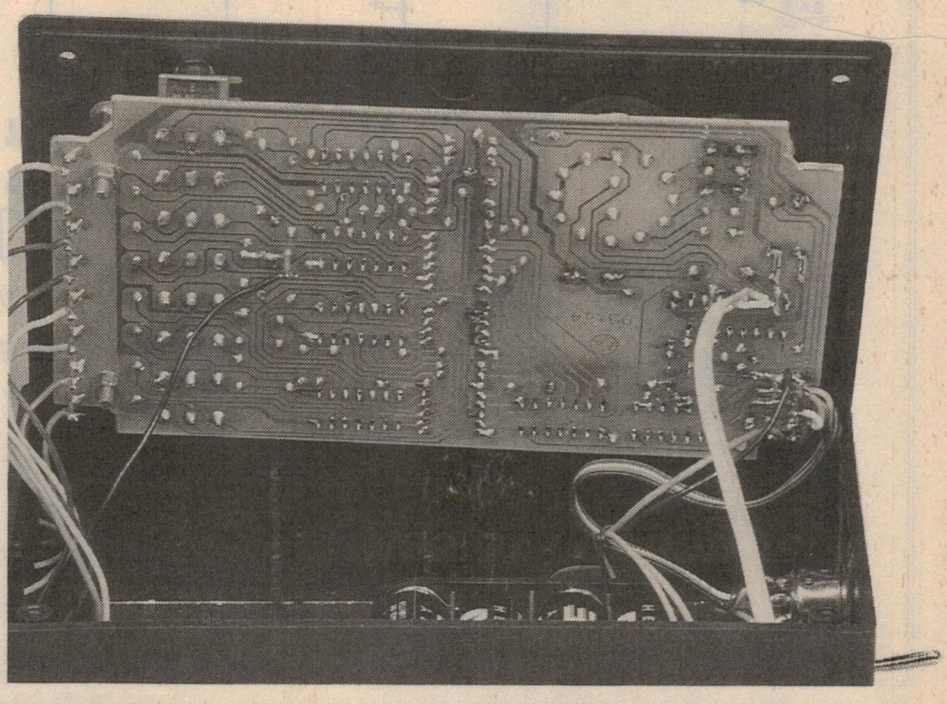
Now, you're probably thinking that this could be done by hooking the scope's external trigger input straight on to the display's strobe line; and you would be right. But imagine a more complex situation involving many strobe lines, of different polarities...

Once the required input condition appears on the DTA's inputs, it sends a very narrow trigger pulse off to the oscilloscope. This pulse can be delayed from 1us up to 1ms after the event occurred, by setting the coarse and fine controls on the front panel.

A delayed trigger is very useful as it allows you to increase the sweep rate on the scope and effectively 'zoom in' on the displayed waveform. By varying the delay time using the 'Delay adjust' knob on the front panel, you can see any part of the incoming waveform at a much higher resolution due to the higher sweep rate.

Of course you don't need to use all of the eight inputs — by selecting one input for use and setting the other seven switches to the centre 'Don't care' position, the unit becomes a standard delayed trigger — a useful tool in its own right.

The DTA also lends itself for use as a bit pattern detector. With up to 24 inputs (once you've added expander units), not only can full address decoding be accomplished, but if used in conjunction with a UART, serial RS-232C



Bottom view of the PCB. All of the wires are soldered to PC pins installed from the copper side of the board. You can just see the four cell battery holder mounted in the bottom of the case.

communications can be decoded and analysed.

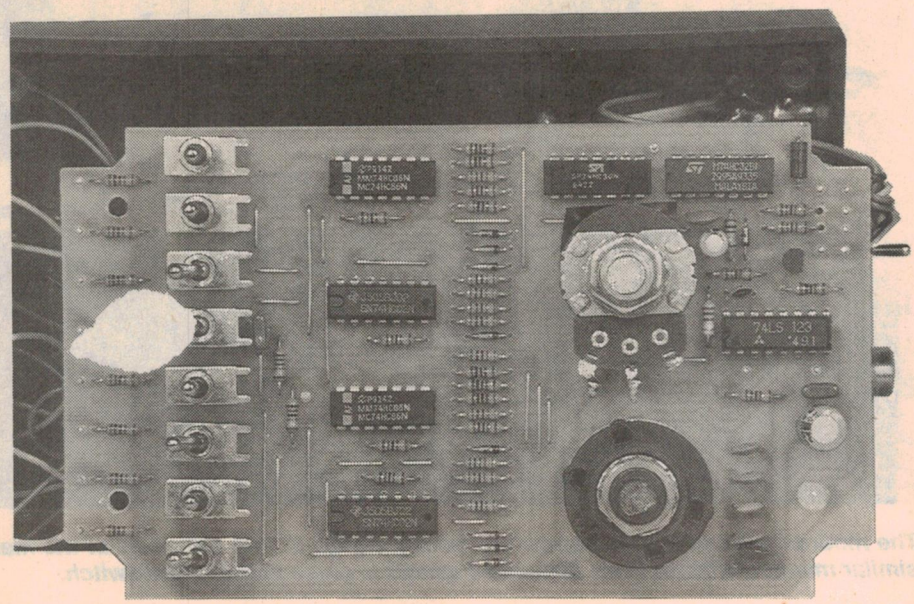
Circuit details

The circuit of the DTA falls rather neatly into two halves, the first part containing the input switching and event detection, while the second contains the delay and trigger pulse generating circuitry. As you can see from Fig.1, the input section of the circuit is repeated eight times — one for each input. Looking at one of these input circuits, it can be seen that when the two inputs of the EX-OR gate are at the same logic level, its output goes low. By labelling the input selection switch seemingly backwards, as shown, the gate produces a high whenever the input logic level matches the switch position.

The NOR gate associated with each input is to detect when the switch is in the centre 'don't care' position. This is done by tying both inputs low through 10k resistors, and using the high from the switch to bring one of the gate's inputs high.

When both inputs are low, in the 'don't care' switch position, the high on the NOR gate's output is passed through D1, overriding any output that the EX-OR gate produces, with a resistor preventing the NOR gate from forcing the EX-OR's output high.

The outputs of each of the input detectors, then, will go high either when the input logic levels match their corresponding switch settings, or when the switch is set to its centre position.



A top view of the master PCB. Note the two mounting holes next to SW2 and SW7, and that only two of the three lugs on RV1 are connected.

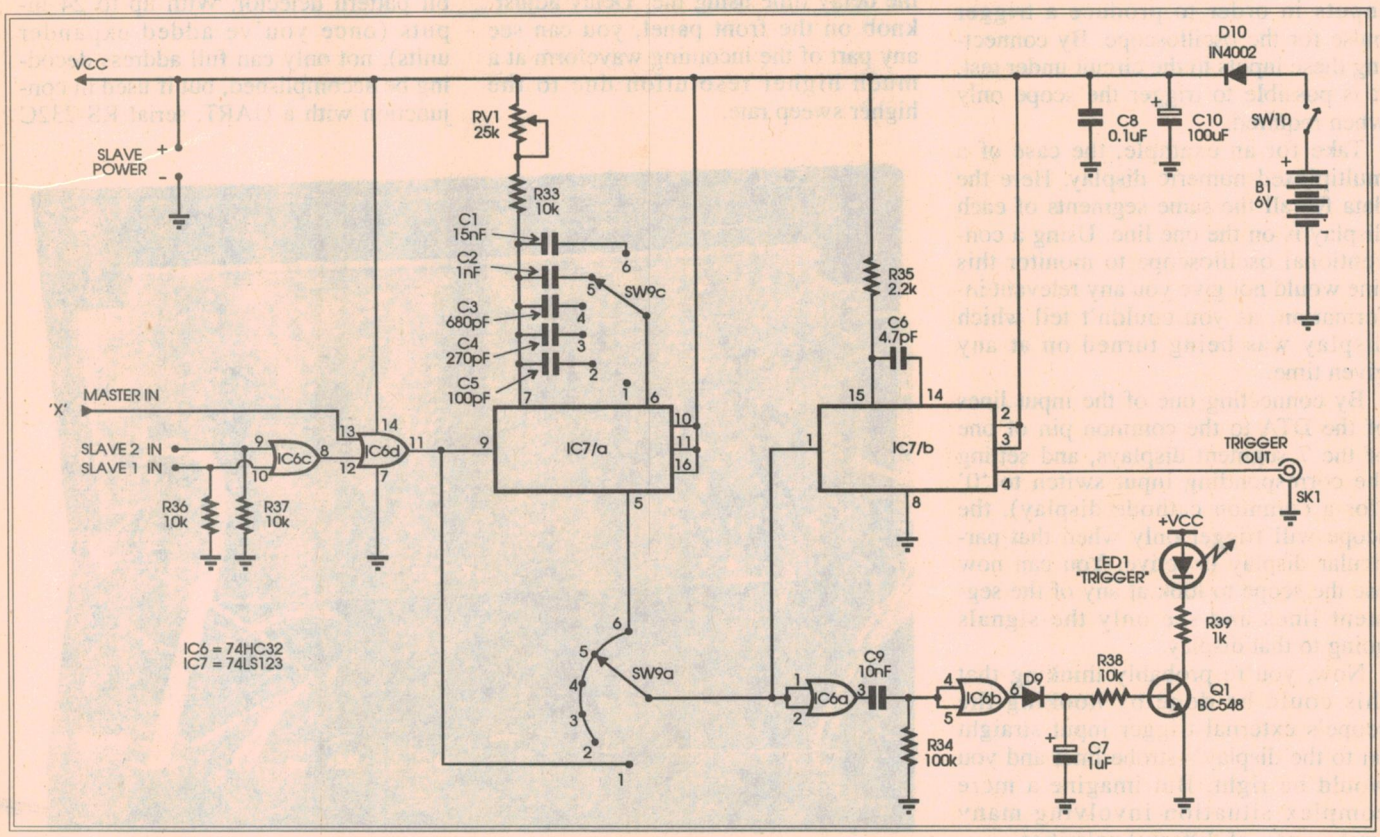


Fig.2: The delay and triggering section of the circuit, used only in the master unit. IC6 incorporates the inputs from any slave units connected, while IC7a produces the delay determined by SW9c and RV1. Switch 9a selects between delayed or 'straight through' signals. IC7b generates the trigger pulse for the oscilloscope.

IC5, an eight input NAND gate, accepts the outputs from all eight input detectors, and its own output goes low only when all of the input conditions are met.

This 'event found' output is used as the main output for the slave units, but in the master unit it is passed on to IC6, a quad OR gate (Fig.2). Both IC6c and IC6d mix the outputs from the master and any slaves connected and pull the input to IC7a low only when *all* 'event found' outputs are low. R36 and R37 keep the inputs of IC6c low so that the master will operate alone, without any slaves attached.

IC7a is set up as a negative edge-triggered monostable, with an output period determined by RV1 and the capacitor switched in by SW9c. SW9a serves to switch between the undelayed signal from IC6d or the output from IC7a, an effectively delayed signal. IC7b is again edge-triggered, and set up to produce a narrow (0.1us) negative-going pulse, used to trigger the oscilloscope.

A 74LS123 is used to produce the delay and trigger pulses because it was found that the HCMOS version (74HC123) wouldn't produce a pulse narrower than 200ns. This is a bit limiting, as the upper frequency limit would be around 5MHz. While the 'LS' or low power Schottky IC draws about 16mA more than the HC version, it was felt that the higher frequency response outweighed the slightly higher battery drain. If you won't be using the DTA at frequencies higher than 5MHz, the HCMOS IC can be substituted, giving longer battery life.

The 'Trigger' LED indicates whether the DTA is actually triggering, as the unit cannot trigger if the delay period is set to be greater than the period of the incoming waveform. IC6a buffers the signal at the input of the trigger pulse generator IC7b, and this signal is integrated by C7 and R8. When the voltage on C7 rises above 0.6 volts, Q1 turns on and the LED lights — indicating that an AC signal is present on the input of IC7b. If the unit isn't triggering, a constant high will be present on IC7b's input due to IC7a being constantly retriggered. This high will be blocked by C9 and as a result, the voltage on the base of Q1 will fall and the LED will turn off.

Construction

As you can see from the photographs, the DTA fits into a small plastic jiffy or 'zippy' box measuring 50 x 90 x 150mm. The circuit board mounts be-

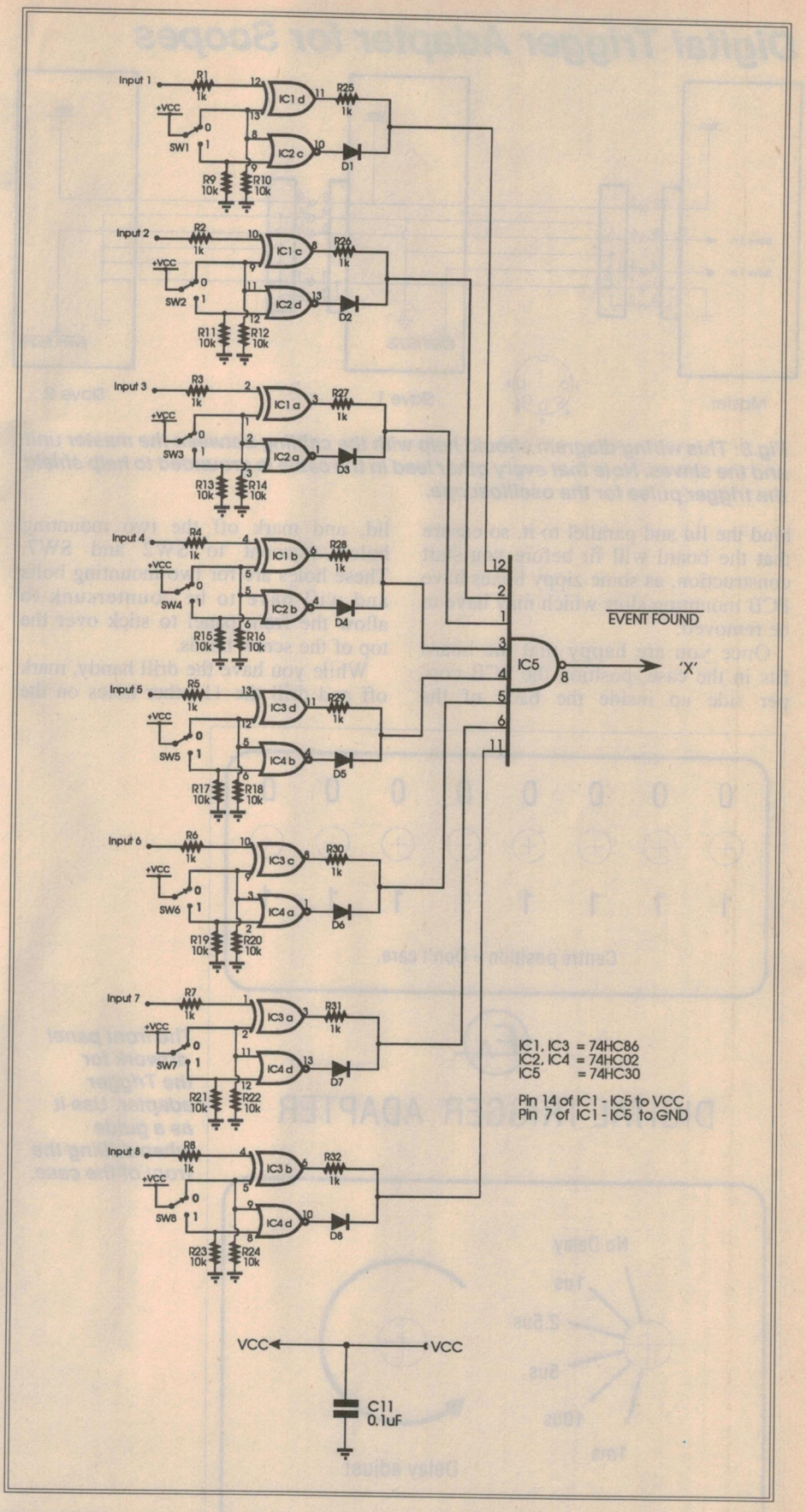


Fig.1: This is the schematic for the input section of the Digital Trigger adapter. The 'event found' output connects to the circuit in Fig.2 for the main unit, but is the main output for the slave units.

Digital Trigger Adapter for Scopes

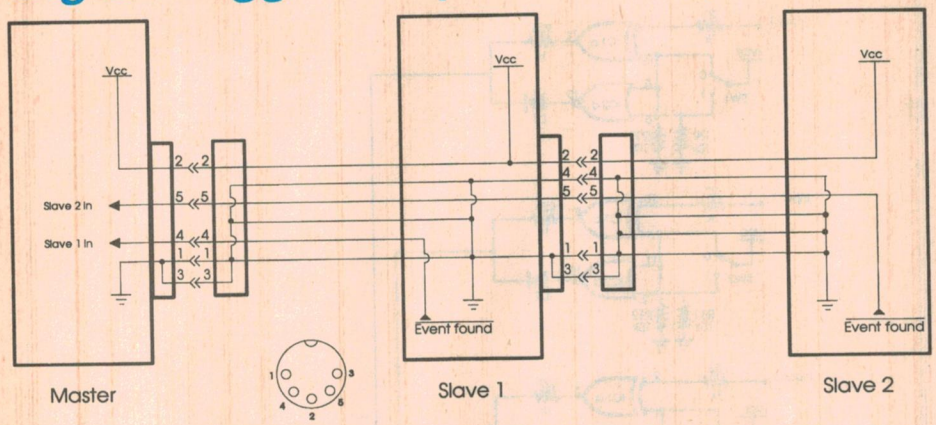
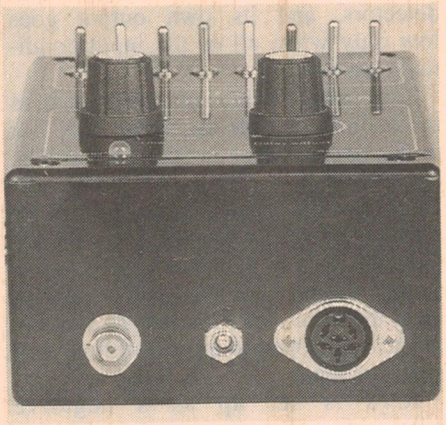


Fig.3: This wiring diagram should help with the cabling between the master unit and the slaves. Note that every other lead in the cable is grounded to help shield the trigger pulse for the oscilloscope.

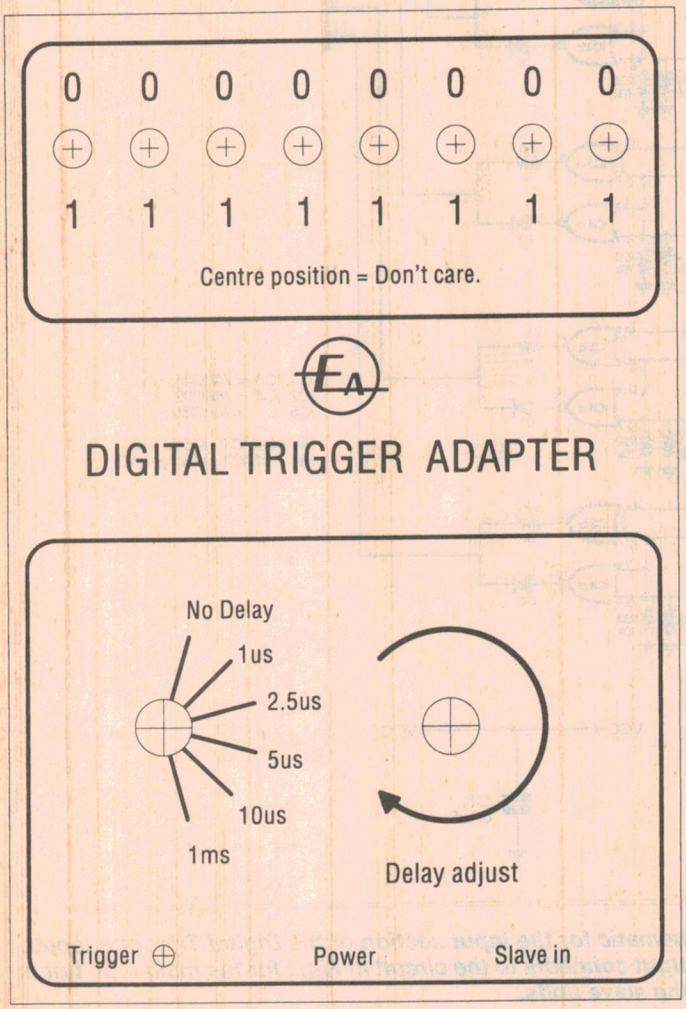


An end view of the master unit, showing the trigger output, on/off switch and the slave input socket. (A six pin DIN socket was used in the prototype.)

hind the lid and parallel to it, so ensure that the board will fit before you start construction, as some zippy boxes have PCB mounting slots which may have to be removed.

Once you are happy that the board fits in the case, position the PCB copper side up inside the back of the lid, and mark off the two mounting holes adjacent to SW2 and SW7. These holes are for two mounting bolts and will have to be countersunk to allow the front panel to stick over the top of the screw heads.

While you have the drill handy, mark off and drill the 11 other holes on the front panel using the front panel artwork (or a same-size photocopy) as a guide. Also, now would be a good time to check to see if the holes in the PCB are big enough to accommodate both the rotary and input switches, and re-drill if necessary.



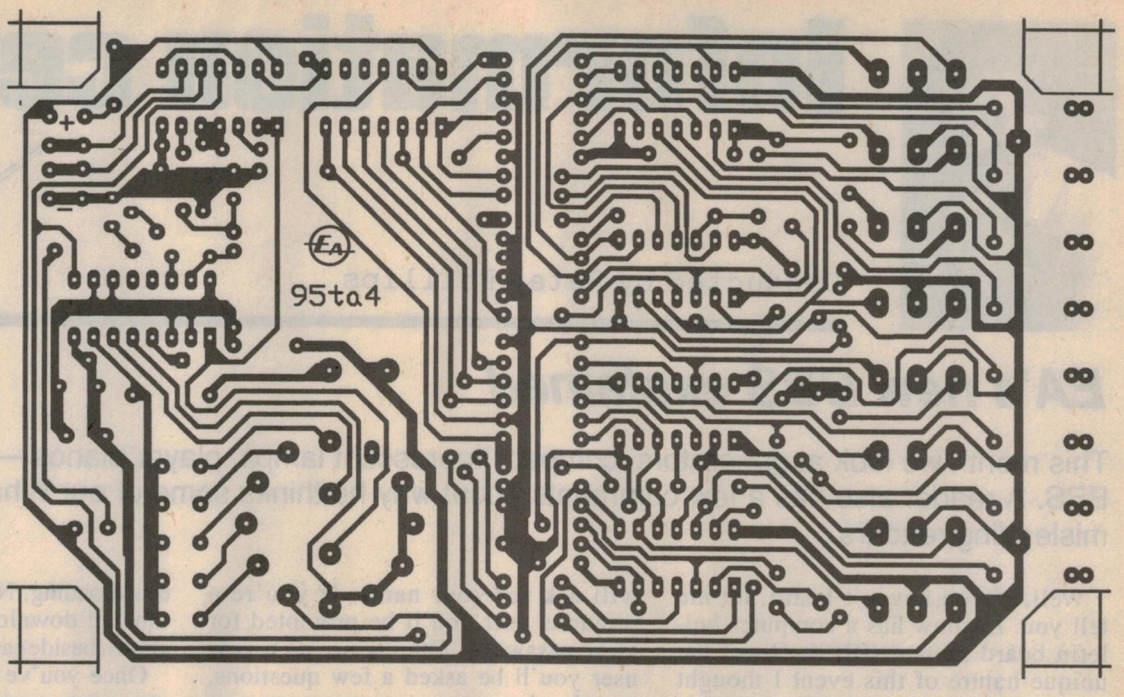
The front panel artwork for the Trigger adapter. Use it as a guide when drilling the front of the case.

There are 26 links to be installed on the PCB, and these are best fitted before the other parts get in the way. Pre-form the links with pliers and solder them in place, making sure that they are flush with the board. Use insulated wire for the two links under RV1, as they may short against the pot when the unit is finally assembled.

Next install the resistors and diodes, followed by the capacitors and Q1. Mount the seven ICs next, observing the usual anti-static precautions for CMOS, and be careful soldering around IC2, where a track runs between pins 11 and 12. PC pins are recommended for the eight inputs, trigger out and power connections, and can be soldered in now, along with LED1.

Now install the eight input switches. The board has been designed to accept the more common right-angle PC mount SPDT/Centre Off switches (SW1-8). These will need to have their leads straightened with a pair of pliers, in order to mount them vertically. (Don't worry, the pins are made from brass and are quite robust!) Once straightened they must be carefully aligned on the board, as they will have to protrude through the holes drilled in the front panel.

Ensure that each switch is pressed down firmly onto the board, and by only soldering the centre pin of each



The actual size PCB for the Trigger Adapter, shown here actual size for those who wish to etch their own boards.

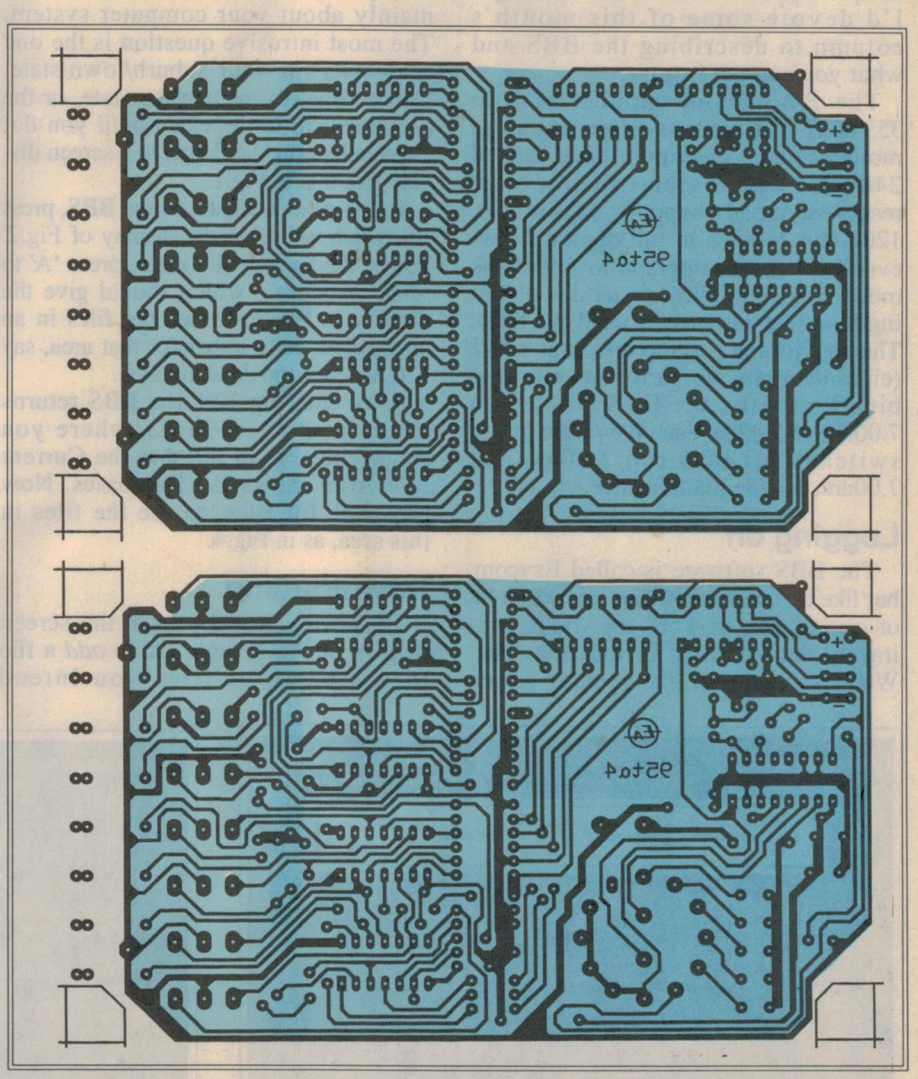
switch to start with, you can check that they all line up and make any adjustments before finally soldering the rest of the contacts.

Solder two lengths of stiff tinned copper wire to the right hand pair of lugs of RV1, but do not mount it on to the board yet, as it will be soldered in place after the board is mounted in the lid. The six-way rotary switch SW9 is next; it will fit in one of two ways — make sure that it is positioned so that the knob points the right way on the front panel, before soldering it into place.

The two countersink-head machine screws used to secure the PCB to the box lid should now be installed. The board needs to be mounted 15mm below the lid, with the rotary switch supporting one end of the board and the two screws (with threaded spacers or multiple nuts) supporting the other. Ensure that the screws are well tightened on the spacers or lower nuts, as their heads will not be accessible once the front panel is attached.

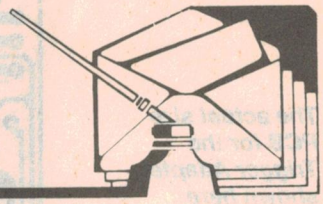
Carefully attach the front panel to the lid and cut out the holes with a sharp knife. After ensuring that the locking washer for the rotary switch is positioned in the '6' hole, mount the 'Delay adjust' pot in the lid and thread the two wires from it through their respective holes on the PCB. Push the board up and work the switches through the front panel, making sure that the LED lines up properly with its own hole. Secure the PCB with two nuts on the two mounting screws and the nut on the rotary switch.

Continued on page 98



At top is an overlay diagram for the master unit and below is the overlay for the slave. Note that all of the links are installed on the slave board.

Information centre



Conducted by Peter Phillips

EA's new BBS explained

This month we look at generators, compact fluorescent lamps, player pianos — and also our new BBS. A reader also has a few comments about why he thinks some of our What?? questions are misleading readers.

Well, if you haven't heard, let me tell you. *EA* now has a computer bulletin board system (BBS). Given the unique nature of this event I thought I'd devote some of this month's column to describing the BBS and what you can get from it.

The BBS phone number is (02) 353 0627. The modem we're using at the moment has a maximum baud rate of 2400b/s, which seems to suit most readers so far as it supports rates of 300, 1200 and 2400b/s in full duplex. However we hope to upgrade to a 9600b/s modem soon, to allow faster downloading by those who need to call via STD. The data format is set to the usual 8-N-1 (eight data bits, no parity and one stop bit). Presently, the BBS is on from 7.00am to 2.00am each day/night and is switched off between 2.00am and 7.00am, for file maintenance.

Logging on

The BBS software is called Ezycom, but like all comms software, it takes a bit of getting used to. Let's say you're calling up the *EA* BBS for the first time. When you connect, the opening screen will ask for your name. If you're a previous user you'll be prompted for your password. Otherwise, as a new user you'll be asked a few questions, mainly about your computer system. The most intrusive question is the one that asks for your suburb/town/state. Don't forget to include the state, or the question will be repeated until you do! Eventually you should get to a screen display like that in Fig.1.

To get an idea what's on the BBS, press 'F' which will give the display of Fig.2. To see the various file areas, press 'A' to select *new area*, which should give the display in Fig.3. To see the files in an area, select the number for that area, say 120 which is the database area.

After entering 120, the BBS returns to the display of Fig.2, where you should be able to see that the Current File Area shows EA Databases. Now press 'F' for files, to see the files in this area, as in Fig.4.

Downloading

To download a file from the screen display of Fig.4, press 'A' to *add* a file to the batch of files you intend downloading. Note in Fig.4 that the estimated download time (at 2400b/s) is shown beside each file.

Once you've entered the file number you want, press 'N' to return to the display of Fig.2. From this menu, press 'D' to download, which will send you to the download menu where you'll be asked to select a download protocol.

The most popular protocol these days is *Z modem*, as it offers the best error correction and speed characteristics. However, make sure your own comms software is set up correctly for this protocol. One of the most common errors is to not specify a download subdirectory. As a result, the downloaded file will not be saved to disk.

After selecting the protocol, another list of options appears. You might like to press 'L' to confirm the file you want to download is in the batch.

To start the download, press 'D'. Your screen display will probably change as your comms software takes over and shows the status of the transfer.

The database

One of the most useful things on the BBS is our database. It extends back to

```
Time Remaining: 102                          Menu Location: Main Menu

   Electronics Australia Readers' Information Service

[F] File Menu       - access files for downloading to your system
[D] Database Menu   - search though EA database lists, while online
[M] Message Menu    - post and read messages to and from EA
[C] Config Menu     - change the system's colour and functions

                                                [.] Log-Off Menu
```

Fig.1

```
Time Remaining: 106                          Menu Location: File Menu

   Electronics Australia Readers' Information Service

Current File Area:  EA Databases

[A] Select new Area          [F] Files list for CURRENT Area
[>] Step to next Area

Global commands (covering ALL file areas):

[K] Keyword Search           [N] File Name Search      [*] New File Search
[D] Download File(s)         [O] Online File List      [H] Help
                             [U] Upload File(s)

[=] Main Menu                                          [.] Log-Off Menu
```

Fig.2

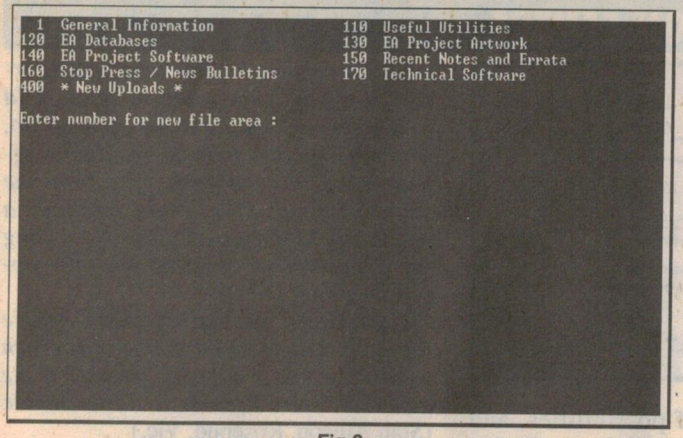


Fig.3

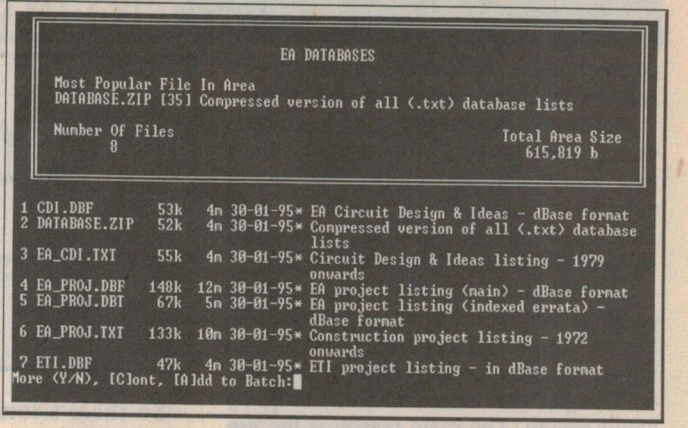


Fig.4

1972 and also covers *ETI* projects. To use the database to find out when a particular article was printed, get back to the main menu (Fig.1) by pressing the '=' key at the menu of Fig.2. Now press 'D' to get to the Database menu. The screen display of Fig.5 will appear, inviting you to enter a number, depending on the particular listing you're interested in.

After entering the number, you're invited to enter a key word that identifies the subject area. If you enter RADIO, every article in the listing that has the word 'radio' in its title will be listed on the screen, as shown in Fig.6.

Beside each listing is the date of publication, starting from the most recent date. Because there's lots of articles about radio, the listing will take several pages. Press 'Y' for the next page, or 'N' to exit.

General

The BBS software is relatively intuitive, although its versatility sometimes makes it confusing. In most cases, pressing the return (or enter) key will do something useful. Virtually all menu screens tell you what keys are active, and after one or two sessions you'll find it easy enough to use.

By the way, it doesn't matter what sort of computer you have. The BBS is running on an IBM-compatible AT computer, and of course some of the downloadable software files are for IBM-compatible systems. However, text files can be downloaded to any system, and the bulletin board can be accessed with any type of computer.

At this stage, we are not offering an upload service, although you can leave a message for the sysop. However, the main use of the BBS at present is as an information service to our readers, not as a way of contacting us.

If you can't find an answer to your query on the BBS, it's still best to write to us, rather than leaving a message on the BBS, as our sysop is really only there to keep the system running. While we're going to try and read all messages left on the BBS, we can't undertake to reply to them individually.

Now to some reader letters on other topics.

Electronic Pianola

As some of you might know, I have a great interest in player pianos, both pneumatic and electronic. So our first letter is certainly right up my alley...

Can you please advise if Electronics Australia has ever featured a project about an electronic piano, organ or any similar musical tone generating device. For your information, my intention is to modify an ancient 'push-up' Pianola piano playing machine, to run electronically.

You may be familiar with the player piano mechanism. It involves passing a perforated paper roll over a bar in which small openings admit air as the holes align. The interior of the mechanism is in a state of partial vacuum and the entry of atmospheric pressure, even in small amounts, through 88 tubed connections, causes tiny pneumatic bellows to open and move the relevant piano keys.

My intention is to replace the pneumatic bellows with pneumatic switches, to control the output of an electronic piano. (Geoff Stevenson, Moe South, Vic.)

Over the years, we have presented a range of construction projects for electronic pianos, organs and the like. Perhaps the most notable recent design is the Playmaster 760 organ, presented in five parts from March to August 1976. Our most recent electronic organ, apart from a simple one described in the Ex-

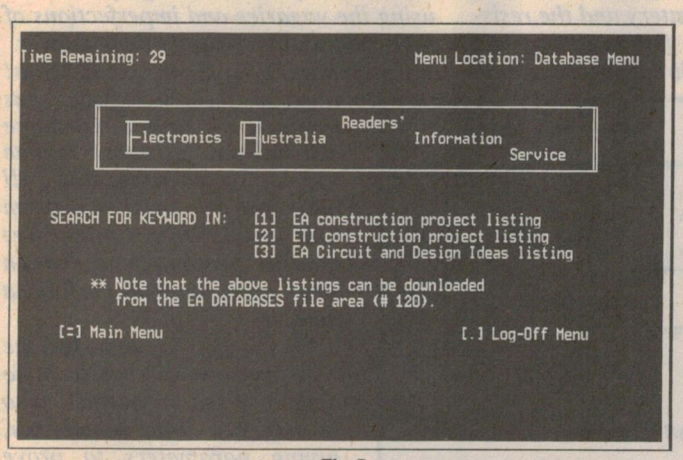


Fig.5

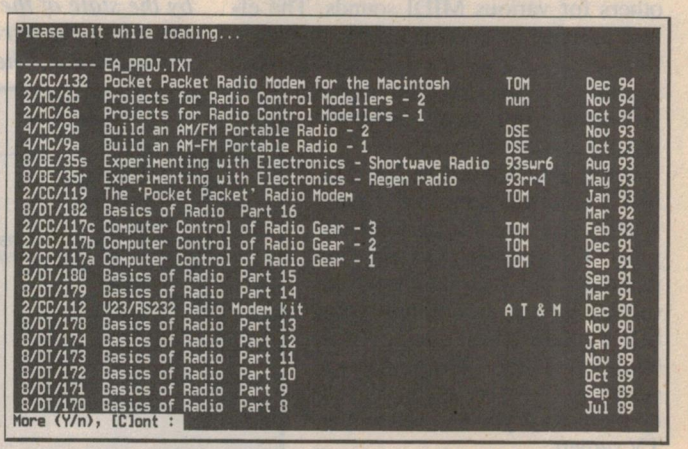


Fig.6

perimenting with Electronics section in July '92, is a keyless organ in July 1981.

The only electronic piano project we've done is the Lyrebird piano, over four issues starting October '81. Sound generators include a synthesiser (Aug '83), an electronic music box (Dec '80) and a musical tone generator (Jul '80).

But as you can see Geoff, most of these projects are at least 10 years old. We haven't produced anything in this field lately, as commercial products are now far cheaper and better than anything we could design. The main reason is the use of dedicated proprietary ICs.

There are a few tone generator ICs available however. I currently have one sent to me by Oatley Electronics. This device covers about one and a half octaves and gives a basic organ-like sound. With appropriate dividers and filters it could possibly be extended. But if you want a range of good quality sounds, I'd advise a MIDI sound box. First purchase a cheap MIDI keyboard that the push-up player can actually play. Alternatively, you might be able to remove the keyboard from the MIDI unit and connect the pneumatic switches you intend installing in place of the keyboard contacts.

The idea is to get a MIDI output signal from the old player, which will be done by the MIDI keyboard. The sound it makes is irrelevant. Once you have the MIDI output signal, connect it to a MIDI sound box and you'll get some amazing sounds. To give you an idea, I'll briefly describe some of the possibilities.

There are currently two systems to convert a conventional piano into a MIDI instrument. One is the Yamaha Disklavier, the other a rather similar system called PianoDisc. Both installations have a MIDI output that can connect to a MIDI sound box.

Typically, a pre-recorded item will have several tracks, one for the piano and the others for various MIDI sounds. The effect is quite wonderful, as the combination of a real piano and synthesised sounds is almost like having a jazz combo or a small orchestra in your lounge room.

But it gets better. The latest in MIDI entertainment is a video, where you see the pianist on your TV screen playing the piano and you hear the orchestra (minus the piano) through your hifi system, with your MIDI equipped piano whipping up a storm as if it were being played by the pianist you can see on the TV screen.

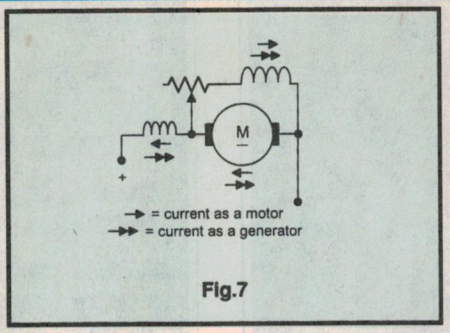


Fig.7

So there's lots of possibilities, and given the large number of piano rolls that were (and are still being) produced, I think you'll have a lot of fun with your 'converted' player.

DC generator polarity

You might remember a story in September '94 about the antics of a WW2 DC generator set.

To start the Renault petrol engine that drove the generator, our correspondent explained he would run the generator as a motor; then when the engine started, he would have to quickly reverse the connections of the generator to get the correct output polarity.

It was a good story, but one that resulted in quite a few letters claiming such a polarity reversal was not possible. A letter to this effect was included in January '95. But the story is not over yet, as the following letter explains:

There is an explanation whereby the generator would have changed polarity after being used as a motor to crash start the engine. The generator would have been internally connected in cumulative-compound mode, to maintain a constant voltage when connected direct to a variable load.

When flashed across a battery, the generator would operate as a series motor with the starting current limited by the state of the battery and the resistances of the series field winding and the armature. The direction of rotation would be correct, but this substantial current flow would cause the magnetic field in the series winding to be opposite to, and much greater than the residual magnetism and the magnetic field from the shunt winding. This would establish a residual field of opposite polarity, causing the generator to build up with the opposite voltage polarity.

Generators for battery charging are normally simple shunt connected, which would prevent a polarity reversal if the generator were used as a starter motor. (Stan Allison, Rosebud, Vic.)

Thanks for this information, Stan. Your wiring diagram of a compound motor is in Fig.7. As the diagram shows, the direction of the current in the series winding changes with generator or motor use, unlike that in the shunt winding.

This view is supported by the next writer, who also has something to say about the What?? questions...

Misleading questions

Referring to Information Centre, January '95 about DC generator polarity, I wish to inform R.G. of Mount Bryan, SA that both cumulative-compound and series field generators cannot be 'motored' without reversing their residual magnetic field polarity, and hence their terminal polarity on resuming life as a generator. Plain shunt field and differential-compound generators are not affected.

My next concern is the very popular What?? questions. I would like to suggest a disclaimer be printed along with the questions and answers, as I feel that contributors are getting away with too much erroneous material, mostly in capacitor and inductor problems.

What annoys me most is the contributor proposing a purely theoretical question, even telling us that the circuit components are perfect, then using the vagaries and imperfections of real components to justify their answer.

For instance, someone said Nyaa! Nyaa! my theoretical battery has internal resistance, someone else had zero resistance, infinite current, zero time, but still managed a Fourier transform and found white noise! Yet another person found enough stray inductance to perform a miracle!

This is bad enough, but the challengers who write in to denounce the antagonist also transgress the questions, giving parameters to prove

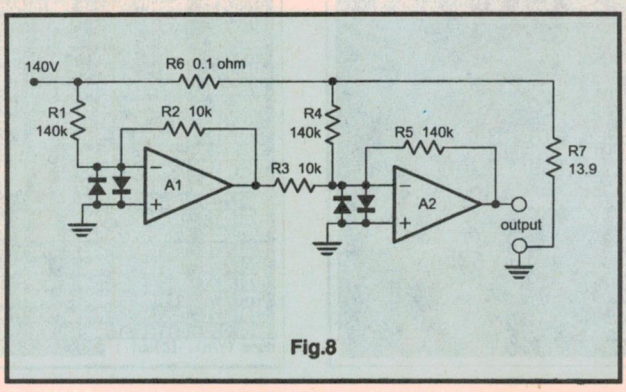


Fig.8

their point. The result is that all are wrong, and some readers will pick up incorrect theory. (Barry Elsmore, Ingleburn, NSW.)

Thanks for making these two points, Barry. I'm not sure I agree with your comments about the What?? questions giving readers incorrect theory. While I'm not above making the occasional mistake (or two), as far as I can remember we've not had an instance where a question claims ideal components with the answer based on real components.

Certainly some questions assume ideal components and others real components, but this is made clear each time. I see a disclaimer as a form of cowardice, or even a cop-out. Instead, it's our role to try and ensure technical accuracy. When we get it wrong, we admit it, and print a correction. But that's about all we can do, other than stop the What?? segment.

Energy savers

We city dwellers sometimes forget that not everyone has mains electricity. Quite a few country folk rely on solar power, batteries and, for mains-rated appliances, inverters. So you'd think these folk would welcome the energy saver lamp as a way to get more light for less power consumption. But there's one problem, as the next correspondent points out...

My home and office are solar powered and thus virtually everything is driven by a couple of 24V to 240V inverters. I use energy saver lights (compact fluoro lamps, or CFLs), but I have found that some of them have a lifespan of around 10 hours — rather short for a $35 price tag, and an estimated lifespan of 8000 hrs.

When I got no response from the local dealer other than some airy-fairy talk about mysterious parameters of inverters, I contacted the manufacturer. As this problem was new to them, they contacted the designer in Germany. To my surprise they told me that this type of light is not recommended for use with square wave inverters. Further, it's good luck and not design that some of these lights survive these inverters!

The reason is apparently that Australian standards are a bit 'overboard' compared with the overseas standards. Unlike other countries, our authorities require that third and fifth harmonics under 25V generated by these lights have to be suppressed as well. Therefore a larger filter capacitor is fitted for our market, resulting in a loss of approximately 1W.

This is rather disconcerting, as this 1W is quite a large amount if the light uses only 7W to generate a light output equivalent to that generated by a 40W incandescent lamp.

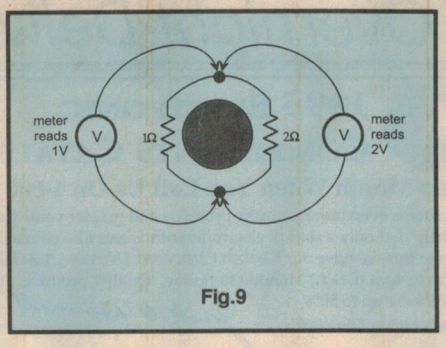


Fig.9

What makes things worse is that this loss, dissipated as heat, is more than 1W when used with an inverter that generates a square wave with its continuous spikes. This results in the electronics getting too hot, and self destruction follows.

The only solution to this problem appears to be to use a more modern type of square wave inverter like the Statpower switch-mode types as sold by Bainbridge Marine. To the best of my knowledge the Statpower inverters do not produce any measurable harmonics, a feature that would also result in a lower hum level, or no hum at all, in hifi equipment.

The extra features and the excellent review of these inverters by Rob Evans in February 1994 suggest that the old transformer type inverters should only be used with motorised equipment like a vacuum cleaner or a washing machine. High efficiency lights and other sensitive electronic gear should not be driven by these; the extra money spent on a switch mode type inverter is cheap insurance. I have learnt the hard way. (Bryan de Pree, Beaufort, Vic.)

Bryan also included a letter from the lamp manufacturer which includes the comment 'the reason (for the premature failure) is that many inverters produce excessive voltage peaks which can damage the electronic circuit, and thus lead to lamp failure'.

When I heard of this, I decided to contact Oatley Electronics. They have been working on an inverter designed to drive CFLs, and I thought they would want to know about Bryan's findings. Instead, they gave a different reason for the failures — and better still, a simple solution to the problem.

According to Oatley Electronics, a CFL has an inverter inside the fitting. It derives its input DC directly from the AC mains with a bridge rectifier, like virtually all computer power supplies. The diodes used in the bridge have similar specifications to a 1N4004 power diode, which is fine when the input is a sinewave, as from the mains.

But when the rectifier is fed with a square wave, the diodes can't always switch quickly enough. As a result, they overheat and burn out. Sound familiar?

The answer is to convert the 240V AC to DC before applying it to the lamp, using a bridge rectifier comprising fast switching diodes and with a 0.47uF 240V AC mains-rated capacitor across the DC output. The capacitor inside the lamp will smooth the DC, but now the internal diodes are no longer being switched. The diode type specified by Oatley Electronics (who have them available by the way) is an MR856.

This solution doesn't prevent failure caused by excessive output voltage from an inverter, due to switching spikes or poor regulation. But I'd be very tempted to try it before replacing your inverter, Bryan.

Lateral thinking

For those who tried my lateral thinking question in March, here's the answer. The next number in the series 1, 4, 7, 11 ... is 14. There's nothing mathematical about this, it just happens that the numerals 1, 4 and 7 are the only numerals made up of straight lines. All others have circular shapes.

What??

Here's an op-amp question from Bryan Maher, author of *Op Amps Explained*. You should find this problem reasonably easy to solve if you know your way around op-amps.

The question is: what's the output voltage of the circuit in Fig.8? Also, is the circuit practical, given that most op-amps are rated at far less than 100V?

Answer to March's What??

The answer is that it depends on where you connect the meter, as shown in Fig.9. This is not surprising, as if you connect the meter leads together, but linked around the transformer core, the meter will read 3V. Where there are varying magnetic fields, voltage is not uniquely defined. ❖

NOTES AND ERRATA

Versatile Multiple Announcement Recorder (February 1995): The 47k x 8 'SIL' resistor packs for RP1-3 are available from Rockby Electronics in Melbourne, and also from Daktron Electronics (phone (02) 671 1333) as Allen-Bradley part number 709A473J.

The parts list incorrectly shows R28 as 2.7k; it should be 2.7 ohms, as shown on the schematic and PCB overlay. The schematic shows C12 as 22nF, when it is actually 10nF, and also shows C19 as a disc ceramic when it is of course an electrolytic.

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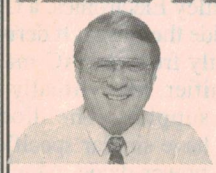

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Regards, **Jack O'Donnell**, Managing Director

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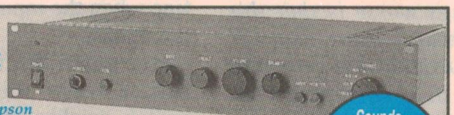
50W Stereo Amplifier Kit



(SC March/April '95)

Congratulations to Leo Simpson and the team at Silicon Chip Magazine for producing this outstanding stereo amplifier kit!

Sensational, natural un-coloured high definition audio is the best way to describe this amplifier. The sound quality and overall specifications of this amplifier will compliment any sound system.

Features: • CD, tuner, VCR, AUX 1, AUX 2, Tape loop inputs • Headphone amplifier • Attractive, professionally, printed and punched front panel • 2U (88mm), 19" Chassis supplied with a durable, industrial grade powder coat finish • Includes toroidal power transformer for minimal hum, heat and greater efficiency • Very simple to build and construct • Chassis can be rack or desk mounted

K 5135 **$349.00**

Sounds so good, your friends wont believe you built it yourself!!

Uses the Virtually Indestructible LM3886 Power IC

The power amplifier circuit of each of these kits comprises of a single National Semiconductor LM3886 chip. This brilliant new IC incorporates an amazing diversity of on board device protection against over voltage, over current, thermal runaway, short circuit load etc.

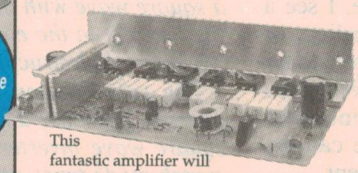
50W Stereo Amp Module Kit

$79.00

(See SC Feb '95) This is a complete stereo output module, including heatsinks, power supply components (less transformer), making it an extremely compact amplifier. Designed around the National LM3886 flat-pack IC. **K 5130**

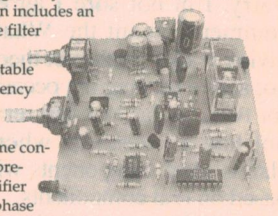
350W Amp Module Kit

K 5180 **$189.00**



This fantastic amplifier will deliver a massive 350 watts RMS into 4 ohms. Using the latest mosfet technology and circuit design techniques this kit is supplied as a basic module, which makes it ideal to be built into subwoofer enclosures, juke boxes and mixers etc. Housed in a suitable enclosure this kit will make a simple superb mono or stereo (using 2 modules) high power amplifier for discos, public address or even in the home if you are game enough to really rattle the floor boards!

Sub-Woofer Controller Kit



(Designed by Altronics) This fantastic design includes an active filter for adjustable frequency cut off, volume control, pre-amplifier and phase shifter allowing the driving of amplifiers in either bridge or single configuration. It also features compressor limiting which means no harsh clipping if over-driven and an automatic power up / power down in response to the audio input. For maximum compatibility it's inputs can be driven from either speaker or line level. The pcb can be housed remotely within the sub-woofer cabinet with its amplifier or at the main equipment rack with the sub-woofer amplifier.

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M 9120 12V AC Plugpack to Suit **$12.95**

Combine the K 5180 Amp Module and the K 5562 for an Impressive Sub-Woofer Circuit!

Guitar Effects Kit

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(See SC Feb '95)

This digital effects unit can produce a wide range of sound effects to enhance a musical instrument. It can be driven from a guitar or line source (or from both) and uses the latest in digital delay technology.

Features: • Echo, delay, reverberation and vibrato effects • Microprocessor controlled delay period and vibrato rate with a 2 digit display • Digital delay processing • Delay adjustable from 1-64 ms in 1ms steps • Vibrato rate adjustable from 1-10Hz in 0.5Hz and from 1-20Hz in 1Hz steps • User presets to select settings on power up • Input attenuator to prevent signal overload • Click free switching between effects in and effects out • No change in signal level between effects in and effects out

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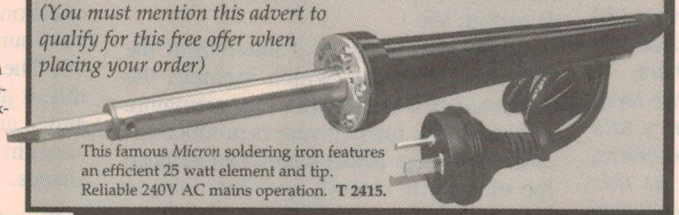

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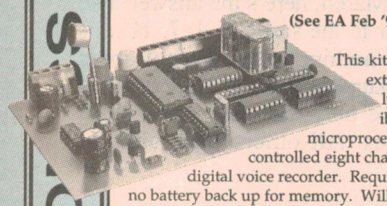
Digital Announcement Recorder Kit

NEW



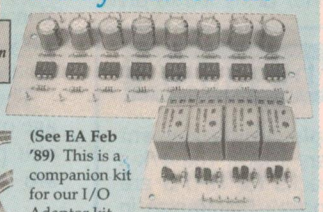
(See EA Feb '95)

This kit is an extremely flexible microprocessor controlled eight channel digital voice recorder. Requires no battery back up for memory. Will record up to 8 different messages, with a total time up to 16 seconds. Each message can be individually triggered. Features chime function, an on-board 2 watt amplifier, negative or positive trigger, once only or recycling announcement function etc.

1000's Uses Include Car Warning Alert, Alarm Systems, Door Bell etc.

K 9580 **$109.00**

Input Buffer & Relay Driver Kit

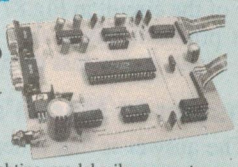


(See EA Feb '89) This is a companion kit for our I/O Adaptor kit (K 2850). It has four relay outputs and eight opto-isolated inputs. This kit contains all parts necessary to construct both the input and output stages and even gives basic information on 240 volt triac controlling. As there is no professional software available for these items, a Qbasic program listing is supplied to help you complete your project.

K 2852 **$34.95**

Combined, the K 2850 & the K 2852 Allow You to Switch On and Off Appliances with Your Computer!

I/O Adaptor Kit for PC's



(See EA July '91) Using this module you can computer control all kinds of things such as security systems, stage lighting, model railways, watering systems etc. The unit simply connects to a standard RS232C serial port on any PC. It has a 8 digital inputs controlling 8 outputs. A simple addressing systems allows multiple units to be "daisy chained" from a single RS232C port, expanding the number of inputs and outputs up to 64.

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Now available - extra deep shelves for multi-play carousel CD players etc.

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H 5363	3 Unit	400mm	120mm	$64.95	$45
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H 5364	4 Unit	400mm	164mm	$69.95	$48

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H 5023	3U	132	122	Natural Anodised	$99.95	$79
H 5031	1U	44	38	Black Anodised	$79.00	$63
H 5032	2U	88	79	Black Anodised	$95.50	$76
H 5033	3U	132	122	Black Anodised	$99.95	$79

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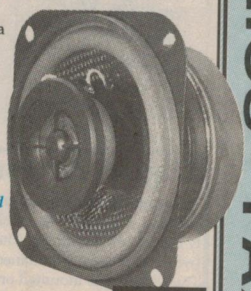

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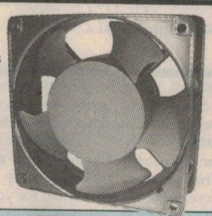

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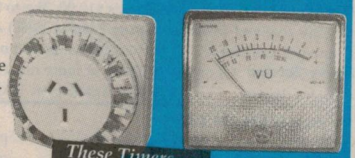

Programming is done by simply inserting the supplied pins into the appropriate time slots. On and off times are in multiples of 30 minutes. Includes manual on/off switch.

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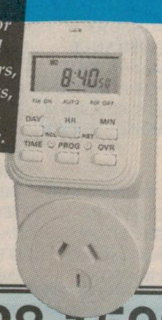
A 0303 $49.50

These Timers Can be Used for Security, Pool Pumps & Heaters, Electric Blankets, Lights, Radios, Reticulation etc.



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Doc.JH131

before. This arrangement didn't even look like working, as the toner refused to transfer. Instead it remained on the paper, with only a hint of the pattern appearing on the aluminium.

After several tries with different temperature settings, all to no avail, we decided to try rubbing the aluminium surface with the same abrasive as used with the PCB laminate.

This made all the difference, and the pattern then transferred perfectly to the aluminium plate. As before, after separating the paper from the aluminium by soaking the lot in water, we found the toner adhered to the aluminium quite strongly (although perhaps not as strongly as with the copper laminate). The last vestiges of the paper were removed by rubbing the aluminium quite hard with a wet finger. However as for the PCB, the pattern was grey rather then black, due to the bonding between the paper and the toner. Coating the aluminium with lacquer made no difference, and we judged the final results to be unsuitable for a front panel.

Then we decided to try the TTS paper. The first problem was deciding which side to use. Nowhere in the supplied literature could we find an answer, so we reasoned that the plasticised side was correct. Unfortunately, because of its thickness, this paper kept jamming in the laser printer.

However, we finally got a copy of the artwork onto the TTS paper and this time when the pattern was dry, the image was pitch black and very crisp. The result is shown in Fig.3. The rather patchy grey scale in the table was an experiment doomed to failure, due to the fine dot pitch. But notice the crisp detail of the black and white printing.

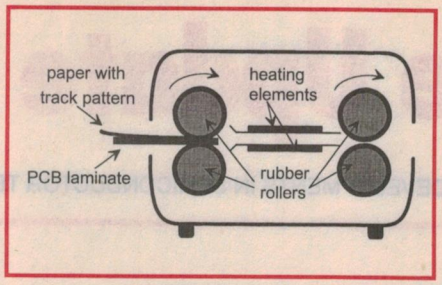


Fig.1: The PCB and transfer paper are passed through a heated chamber, by rollers that are nearly as hot as the chamber. The combination of the pressure and heat transfers the toner to the PCB surface.

Conclusions

There's no doubt the Superfuser and the TTS system work, and work well. If you only want to make PCBs, it seems conventional paper can do almost as good a job as the TTS paper. For aluminium front panels, you'll definitely need the TTS paper.

The advantages of the system are quite compelling. In the first place, the only chemical that's needed to make a PCB is the etchant. You don't need any photographic equipment to make a negative, nor do you need expensive pre-sensitised PCB laminate. The system is quick, quiet and when you've got everything set correctly, reliable. It's also easy to use.

However, there are a number of disadvantages. It doesn't suit mass production, and the results depend on the quality of the printout and the type of toner used by the printer or photocopier. For fine work, a photocopied image might not give sufficiently good results. However, as we've shown, a laser printer certainly does give the required resolution, although we had considerable trouble using the TTS paper with a laser printer.

A problem for many people is the need to get a mirror-reversed image on the transfer paper. In our case, we were able to achieve this with software. Otherwise, the recommended method is to first print the image on a transparent sheet, then photocopy the reverse side of the sheet to get the mirror image.

But perhaps the main problem is the cost of the system. At around $500, the Superfuser is not cheap. Despite its price, the unit is also not as ruggedly built as it could be. It has plastic gearing, and a plastic bearing assembly. In fact, the only metal in the unit is the section holding the heating element.

Used carefully, it's likely the unit will give a long life, but for this price, I would really expect a more robust construction.

The Superfuser consumes 375W, and the temperature range is from 70° to 180°C. The maximum board dimensions that the Superfuser can handle are 305 x 100 x 1.78mm (W x D x thickness). These sizes are generous and should not be a limitation for most users.

The unit is ideal for hobbyists or prototype developers and depending on how many boards or front panels you make, it could work out to be cheaper than using chemicals, photographic techniques and pre-sensitised PCB laminate. And we can certainly say the system works.

The RRP of the Superfuser is $495 (plus tax) and is available from Palmtech, cnr Moonah & Wills Streets, Boulia 4829; phone (077). ❖

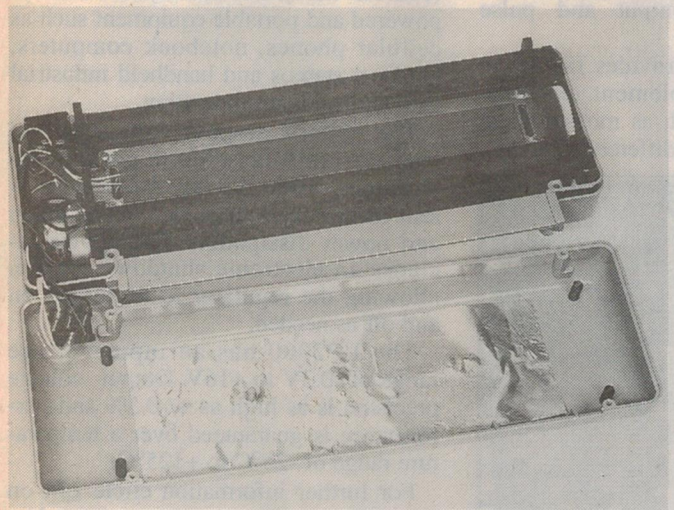


Fig.2 (above): This shot shows the roller and heater assembly inside the Superfuser. The motor driving the rollers is on the left.

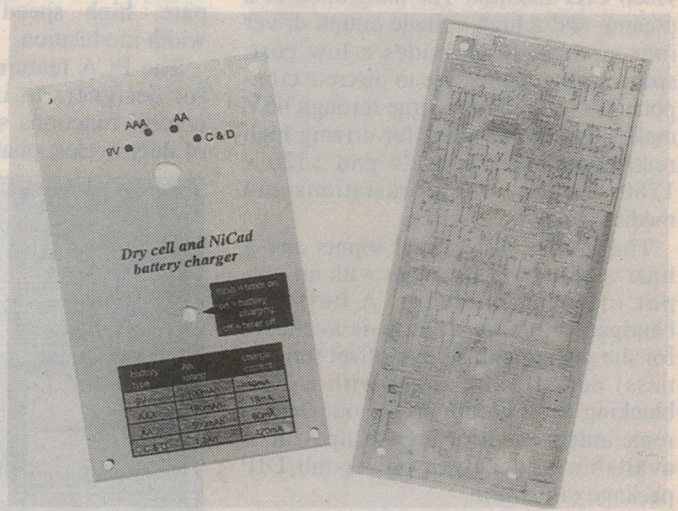
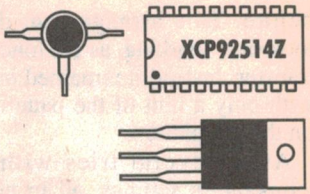


Fig.3 (right): The front panel and PCB we made using the Superfuser are shown here. The grey scale on the front panel is patchy because the dot pitch was too fine in the artwork. A coarse pitch would have given excellent results.

Solid State Update



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Solenoid driver

Lucas Control Systems has introduced a new drive dircuit for all standard Ledex on/off solenoids. Using pulse width modulation (PWM) to achieve voltage adjustment, the new drive circuit offers flexibility for linear tailoring of the output from an actuator, without needing large power components. The device not only keeps costs down and saves on space, but conserves energy.

For example, if a solenoid has 12 volts supplied at 500Hz at 50% duty cycle, the solenoid performs exactly as if it were connected to a six volt supply. If the duty cycle is changed to 25%, the solenoid performs like one operating from a 3V supply. Due to the inductance of the solenoid coil, the current is smoothed, resulting in a constant force.

For further information circle 271 on the reader service coupon or contact MTL Instruments, 13 - 17 Sorbonne Crescent, Canning Vale 6155; phone (09) 455 2994.

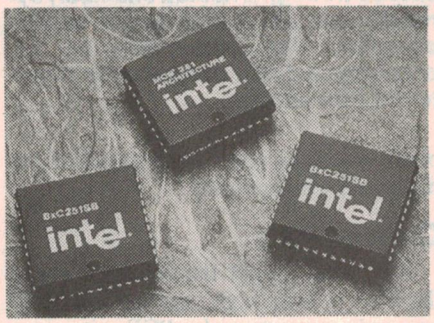
200MHz video driver IC

The MAX 445 from Maxim is a high performance low cost, monolithic, variable gain transconductance amplifier with a high voltage output stage capable of directly driving a high resolution video CRT monitor. The integration of a preamp and a high voltage output driver into a single IC provides a low cost, space saving alternative to discrete components. A 2.5ns rise time through 45V makes this device ideal for driving high resolution (1280 x 1024 and 1520 x 1280) displays for workstations and medical imaging systems.

The IC has differential inputs and a linar adjustable gain stage with an output offset adjustment. A buffered bandgap reference voltage is available for the gain (contrast) and offset (brightness) adjustments along with a TTL blanking input to turn off the output current, independent of signal input. It is available in a 24-pin power-tab DIP package or dieform.

For further information circle 272 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

New microcontroller from Intel

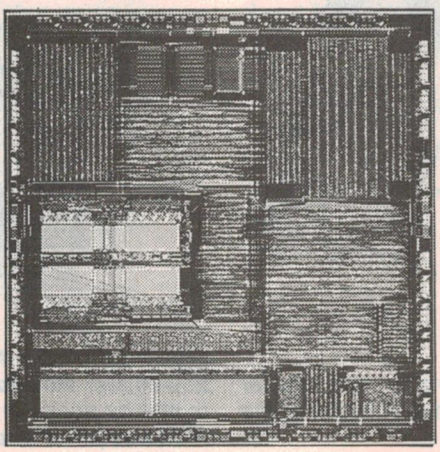


Intel has announced its first product based on the new MCS251 architecture core. The 8xC250SB microcontroller is binary code and pin compatible with Intel MCS51 microcontrollers. It provides a direct 'drop in' replacement upgrade to existing MCS51 controller applications, while increasing performance five to 15 times at the same clock speed.

This improved performance is achieved by implementing advanced controller/processor architecture design techniques, such as a three-stage instruction pipeline and register based CPU architecture, and by enhancing and expanding the instruction set.

The programmable counter array (PCA) on the 8xC251SB controller supports real time capture and compare, high speed output and pulse width modulation.

The PCA feature provides flexibility for designers to implement real time control functions such as measurement of duty cycles, phase difference and frequency, real time interrupt generator and output toggling and adjustable duty cycle generation. The 8xC251SB has 1K byte of on-chip data RAM, and is available with 16K on-chip OTP, ROM or ROMless versions.



The 8xC251SB controller is an ideal upgrade path for existing MCS51 microcontroller applications that need high performance upgrades. It is also suited for applications requiring complex data manipulation functions and real time control capability such as printers, copiers, scanners, CD ROM drives, tape drives, POS terminals, modems, digital phones, cellular/wireless handsets and linecards.

For further information circle 282 on the reader service coupon or contact Intel Australia, PO Box 1486, Dee Why 2099; phone (02) 975 3300.

Low dropout regulator

National Semiconductor has expanded its micropower low dropout (LDO) regulator family with the LP2980, claimed as the industry's smallest LDO. The device is available in 3, 3.3 and 5V versions and is packaged in an 8.2 x 8.2mm five pin SOT-23 pack.

The device features a dropout voltage of 120mV at 50mA (7mV at 1mA) and a quiescent current of 375uA at 50mA (80uA at 1mA). It is intended for battery-powered and portable equipment such as cellular phones, notebook computers, personal stereos and handheld industrial and medical instrumentation.

The 120mV dropout voltage at full load extends battery life in portable applications, while the low quiescent current reduces system power consumption and power dissipation. The device includes an electronic shutdown feature, allowing the regulator to be turned on and off as needed.

The LP2980 has an input voltage range of -0.3V to +16V. Output voltage precision is as high as +/-0.5% and performance is guaranteed over a temperature range of -25°C to +125°C.

For further information circle 274 on the reader service coupon or contact National Semiconductor (Aust), 16 Business Park Drive, Monash Business Park, Notting Hill 3168; phone (03) 558 9999.

Surface mount VHF transistor

Zetex has extended its range of high frequency surface mount devices with an NPN transistor for VHF applications featuring a feedback capacitance of 0.35pF.

This low capacitance increases the useful operating frequency range while reducing undesirable feedback effects, effectively improving circuit stability. It also reduces the Miller effect.

Exhibiting a typical static forward current transfer ratio of 85 at 7mA and 10V, the SOT23 packaged BFS20 can support a peak pulsed current up to 25mA and maximum collector-base and collector-emitter voltages of 30 and 20V respectively.

The device offers useful gain at transmission frequencies in excess of 275MHz at a collector current of 5mA and collector-emitter voltage of 10V. With an operating temperature range of -55°C, it has a total power dissipation performance of 330mW at 25°C.

The transistor is suited to applications where low feedback capacitance, high gain and low cost are critical, such as grounded emitter stages, high integrity telecomms applications, mobile communications, radio and TV IF stages.

For further information circle 275 on the reader service coupon or contact GEC Electronics Division, 38 South Street, Rydalmere 2116; phone (02) 638 1888.

Data compression IC for modems

Stac Electronics has announced the 9410 V.42bis data compression accelerator chip. The 9410 offers improved performance, reduced power consumption and reduced board area by allowing modem manufacturers to use 8-bit rather than 16-bit CPUs.

Modems today typically use an internal CPU to implement data compression. As a result, as modem speeds have increased, the CPU has had to become more powerful. Stac's 9410 allows a low cost 8-bit CPU to be used for high performance V.34 (28.8kb/s) modems.

The device offers benefits for PCMCIA modem manufacturers as less RAM and ROM is needed (8-bit instead of 16-bit) reducing the total board area required for the modem. Also, less heat is generated by the CPU. For end users, the ability to get 16-bit performance, with an 8-bit CPU means lower cost, and lower power consumption for longer battery life.

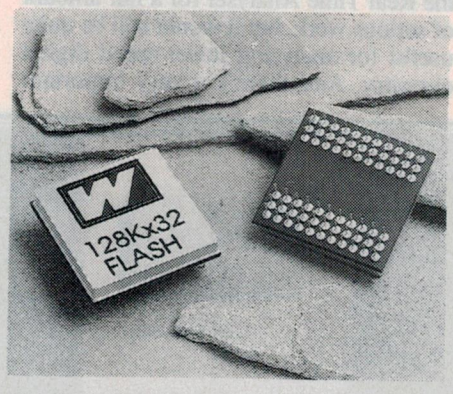
For further information circle 277 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

4Mb flash memory modules

The US Defense Electronics Center has qualified two families of 32-bit configured, 4-megabit CMOS flash PROM memory modules made by White Microelectronics. The 66-pin devices are housed in a standard PGA type hex-in-line (HIP) hermetic ceramic package with standard pinouts.

Two package sizes are available. One measures 30.1 x 30.1mm, the other 27.2 x 27.2mm. The devices are in full compliance with MIL-STD-883 and MIL-H-38534 and will be on the QML-38534 Qualified Manufacturers List. White Microelectronics is certified to MIL-STD-1772.

The WF128K32-XHX offers access



times of 120, 150 and 200ns, features 12 volt programming, a 5V supply with a typical standby current of 4mA and full chip erase. It has been assigned SMD 5962-94610. The WF128K32-XHX5 features access times of 70, 90, 120 and 150ns with 5V only operation and a typical standby current of 1mA. It has been assigned SMD 5962-94716.

Organised as 128Kx32, these modules are user configurable as x16 and x8. All are available with temperature ranges of 0°C to 70°C (commercial), 40°C to +85°C (industrial) and -55°C to +125°C (military). Screening to military standards is an available option. The 5V device features a uniform sectored design of eight equal size sectors of 16K bytes each. This allows easy update of selected sectors, since any sector, or combination of sectors can be erased and rewritten.

Both have a low power CMOS design and TTL compatible inputs and outputs, hardware and software write protection and are rated for 100,000 erase/program cycles, at 0°C to +70°C and a minimum of 10,000 cycles at 125°C.

For further information, contact Jack Bogdanski, White Microelectronics, 4245 E. Wood Street, Phoenix, AZ 85040, USA; phone (602) 437 1520.

High performance shielded VCO

A new series of voltage controlled oscillators has been released by the US Synergy Corporation, covering various bandwidths from 200MHz to 3000MHz. The VFC series is available in a plug-in or a surface mount configuration, with most models operating over a full octave bandwidth.

The new models have a hermetically sealed package with the advantage of RFI/EMI shielding for critical applications that cannot tolerate RF interference. The tuning voltage for octave bandwidth models is nominally one to 20V and bias requirements are 12V DC at 25mA for generating a typical full power output of +13dBm.

When phase locked to a reference oscillator, the VFC series of VCOs can be used as a high performance synthesised signal source.

They can also be used as wideband modulators in laser based acousto-optical applications, due to the their highly linear tuning characteristics. When a low frequency tone is summed into the tuning port, the linear transfer characteristics of these VCOs can produce a frequency modulated output useful for information transmission.

For further information circle 280 on the reader service coupon or contact Electronic Development Sales, PO Box 822, Lane Cove 2066; phone (02) 418 6999. ❖

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READER INFO NO. 23

SOFTWARE-BASED LOGIC ANALYSER

The Logixell Real Logic Analyser is a software package which allows you to use your IBM compatible PC as a simple five-input logic analyser, via a cable attached to its standard parallel printer port. This gives what must be the cheapest possible PC-based logic analyser, even though the sampling rate is inevitably only modest.

Full scale logic analysers are very expensive instruments, and way outside the budget of most of us. As a result, there's potentially a lot of appeal in a lower cost approach based on a PC.

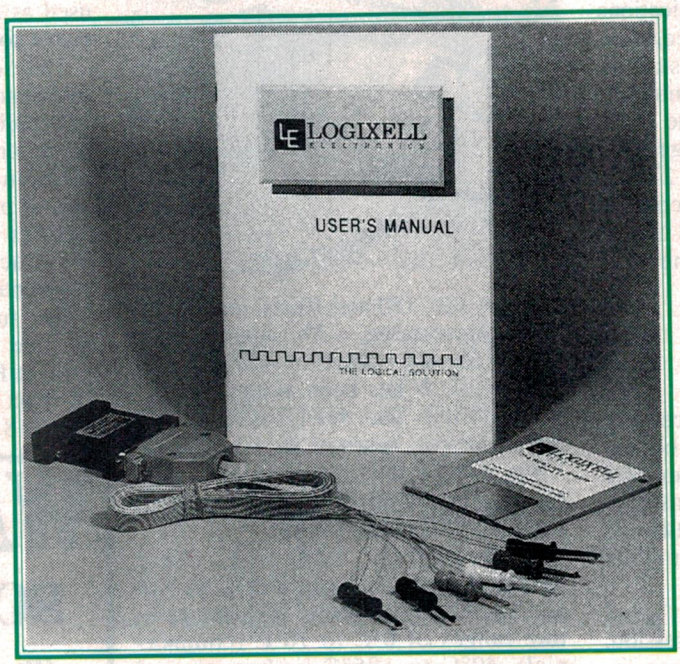
A few PC-based analysers have appeared, most of them based on a custom hardware subsystem module which either plugs directly into the PC, or takes the form of an 'outboard' unit which connects to the PC via an RS-232C serial port, a standard parallel printer port or an IEEE-488 port. These units can achieve quite impressive performance, but still tend to be on the fairly expensive side.

The Logixell Real Logic Analyser takes a much simpler approach, based on software. It takes advantage of the fact that although the standard parallel 'Centronics' printer port of a PC is basically used for data *output*, it also provides five *input* lines which are normally used for 'handshaking' feedback from the printer to the PC. By connecting wires directly to these input lines, custom software can therefore be used to sample the logic levels to which they're connected, to produce an extremely simple and potentially low cost analyser.

Of course there's no free lunches in this world, and this simple approach has some inevitable limitations. One limitation is that there are only five inputs, which is rather too few for many applications. Another is that the maximum rate at which the 'analyser' can sample the input logic levels is limited by how fast the software running on the PC can 'read' from the parallel port. This will depend largely on the processor used and its clock speed, so it will vary from computer to computer.

The Logixell literature suggests that with a 286-based machine with a clock speed of 12MHz, the maximum sampling rate will typically be about 384kS/s, or about one sample every 2.6us. On the other hand with a 386-based machine running at 40MHz, the rate will rise to about 833kS/s or about one sample every 1.2us. Presumably a 486/66MHz machine would give faster sampling again.

These limitations are likely to rule out the Real Time Analyser for a fair amount of serious work, but it would still be quite useful for analysing lower-speed digital circuitry. And there's a very important application for which it would still be very well suited, considering its modest price: education and training. I imagine that schools and colleges should be very interested in the Real Time Analyser, because for the price it would make an excellent tool for allowing students to get good 'hands on' experience with the basic techniques of logic analysis.



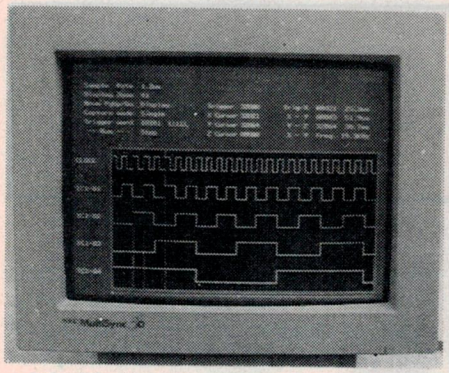
Logixell's RTA software includes a high speed assembly language routine which achieves the highest possible reading of the parallel port, and stores up to 64KB of sampled data in memory. The rest of the software provides a friendly interface whereby the sampled data can be viewed, measured and either stored on disk or printed out.

The software allows full trigger-word programming, selection of pre-trigger and post-trigger event viewing, and measurement of signal waveform time and frequency, using four cursors. It automatically calibrates the effective sampling timebase every time it fires up, so that it can be used on virtually any machine. The display routine refreshes the sampled waveforms at over three times per second, giving a quite convincing 'real time' display.

Other features of the software are the ability to present the displayed waveforms in any colour, and in any order on the screen; the ability to 'zoom in', to examine small waveform details (10 different zoom levels); and the ability to select either of two sampling rates: the maximum possible on your PC, or a fixed rate of 10kS/s (100us per sample). It's also easy to provide the sampled waveforms with a text-string 'title', before saving them to disk, printing or exporting them in the PCX file format.

The Logixell user manual explains how to drive the software quite thoroughly and clearly, although it insists on describing sampling *rates* in terms of per-sample time, and compounds the error by using an upper-case 'S' for seconds (e.g., 100uS). In the international SI system the capital S is used to represent the Siemens (unit of conductance, formerly the mho), while the lower-case 's' is used for seconds.

Apart from that, though, the manual is fine and even gives the wiring connections for making up your own input cable, using a DB25 plug at one end and test clips at the other.



The main screen display of the RTA software, with five traces visible.

For those who don't wish to wire up their own cable, though, a suitable pre-wired cable is available as an optional extra. Also available is a small buffer unit, which connects between the PC's printer port and the test cable, to allow you to connect the test leads to circuits which use higher voltage levels than TTL (up to +/-75V, in fact). This would extend the RTL's uses to CMOS and RS-232C circuits, for example, and also some industrial control circuits.

Trying it out

We tried out a sample RTA with a couple of different machines, one a 286/12MHz 'AT' clone and the other a 386/33MHz. The software installed in each case without any hassles, and using it was also very straightforward. It provides a clear and friendly user interface, allowing you very easily to set the trigger word, capture a signal, zoom in to examine any desired part, save it to disk or retrieve it again later. It's also easy to print it out or export it to another package.

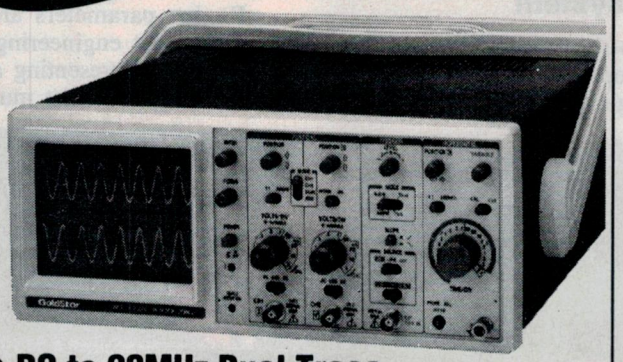
Our impression, then, is that the Logixell Real Logic Analyser is a neat and low-cost solution for those who really only need a modest-speed analyser with no more than five inputs. It would probably be ideal for schools and colleges, to give as many students as possible some direct practical experience in the use of a logic analyser.

The basic Real Logic Analyser package is priced at NZ$200, with the ready-made test cable a further NZ$30 and the optional parallel port buffer NZ$50. The software source code is also available, for those who would like to have it, for a further NZ$30. Postage and handling is a further NZ$5, while customers in New Zealand would need to pay a further 12.5% GST.

Further information is available from distributor Gray Enterprises, of PO Box 75, Takanini, Auckland NZ; phone or fax 64-9-298 7356. (J.R.) ❖

GoldStar

NEW 20MHz



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Record Length/Channel	2k	2k	2k
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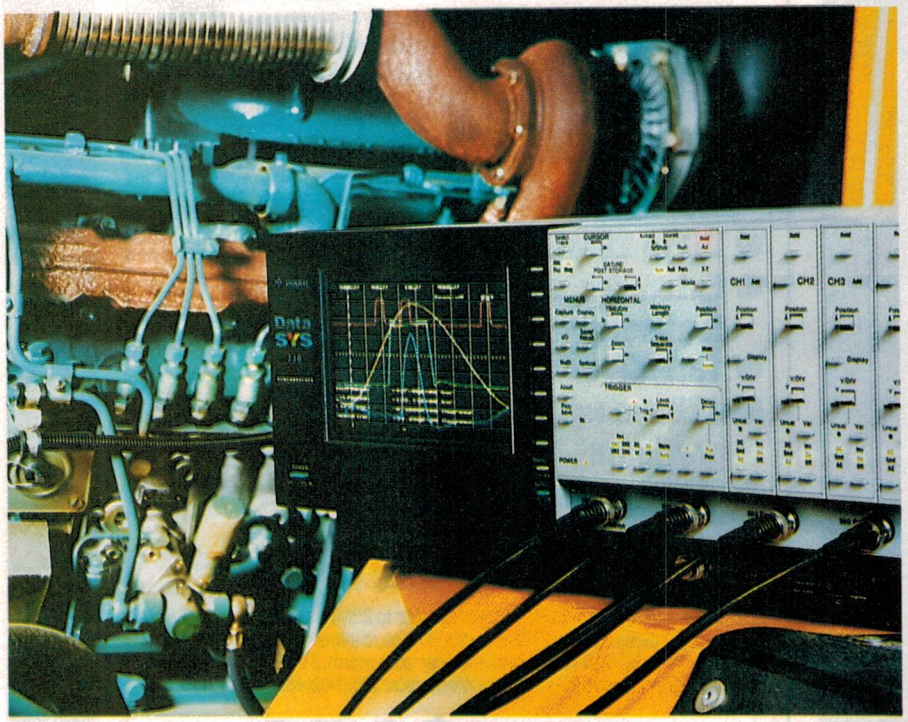
READER INFO NO. 24

NEW PRODUCTS

Engine/motor testing system

The Gould DataSYS model 770 Synchroscope is a portable test system for rotating machines, and is particularly suitable for monitoring the performance of automotive engines.

Engine parameters are displayed in their correct engineering units, against time bases representing a single engine revolution or preset multiples. This is achieved by sampling the engine signals every 0.1° of rotation. The input for the angle of rotation can be from optical shaft encoders, standard electronic pulse signals such as those provided by electronic ignition systems, or from proximity detectors.



Customised test routines are easily set up, by means of a self test feature. This simplifies routine tests and improves reliability of results. Routines can vary from a simple repeated measurement and printing of a single parameter to a complicated test routine which might otherwise involve some hours of computer programming.

The DataSYS is equipped with EEE-488 and RS-423 interfaces for interfacing to external data processing equipment. This feature together with on-board storage through mass storage options including RAM disk (349K byte), hard disk (120M byte), floppy disk or memory cards, facilitates data reduction programmes such as Fourier analysis, correlation and cross relation studies.

For further information circle 242 on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066; phone (03) 419 9999.

Portable analog circuit tester

Advances in technology and the increasing pressure for network providers to re-use the existing copper networks mean that new methods of increasing the usability of a local network for high speed data applications are being employed. These new applications often demand ever increasing test capabilties in a portable instrument.

Wandel & Goltermann has developed the new data line analyser DLA-9 to meet these requirements. The instrument can be used for testing many types of traditional telephone and analog data circuits, in the range of 20Hz to 20kHz. It can also be used for testing circuits for new applications such as high speed data and basic rate ISDN in the range of 200Hz to 200kHz.

Additional applications include commissioning, maintaining and troubleshooting two wire leased circuits, two wire switched PSTN circuits and four wire leased data circuits. The DLA-9 can also be used for full channel analog to analog measurements on PCM multiplexers, cable selection for ISDN basic rate U-interface and other high speed data appliations.

For further information circle 241 on the reader service coupon or contact Wandel & Goltermann, 42 Clarendon Street, South Melbourne 3205; phone (03) 690 6700.

Low cost nanovolt, micro-ohm meter

Hewlett-Packard has released a new high sensitivity nanovolt/micro-ohm meter, the HP 34420A, which is claimed to bring reading noise down to half that of competitive meters, and also to offer a breakthrough in price/performance. The new meter is intended for metrologists, researchers and component testers who need high confidence in very low-level DC voltage and resistance measurements, as well as high-resolution temperature measurements.

The HP 34420A offers low-noise input amplifiers and a highly- tuned input protection system which brings reading noise down to 1.3nV RMS, half that of other meters in this class. This breakthrough is combined with 7-1/2 digits of resolution, 2ppm basic 24-hour DC voltage accuracy and selectable analog and digital filtering. An integral two-channel programmable scanner for automated ratio and difference measurements eliminates the need for an external scanner.

A built-in high precision current source is used for low resistance measurements. An offset compensation feature minimises thermal EMFs, which would otherwise compromise measurement accuracy.

For sensitive temperature measurements the HP 34420A has built-in conversion routines to display thermocouple, thermistor and RTD readings directly as temperature. with up to 0.001°C resolution. Other features include scaling and statistics functions, a 1024-reading memory, RS-232C and HP-IB interfaces, and both SCPI and Keithley 181 programming languages.

The basic cost for the HP 34420A is $4700. For further information call HP's Customer Information Centre on 131 347, extension 2902. ❖

New Electrostatic Safe Soldering Station

THE VERSATILE SA-562E-A

DESIGN FEATURES

- LED heater indication
- Variable temperature control knob
- External calibration ports
- Slim-profile iron handle with silicone rubber grip • Flexible, non-burn silicone iron cord sleeve • Externally fused
- Aust. Energy Authority Approval No. N-1/933
- Closed loop temperature control
- 315°C to 425°C
- Electrostatic discharge safe

$136.00 Sales Tax Not Included.

SPECIFICATIONS – SA-562E-A:
• Input: 230V AC, 50/60 Hz • Iron: 70W, 230V
• Heater: Ceramic with Embedded RTD • Cord: 3-Wire, Australian Plug
• Dimensions: 117.5mm x 115mm x 133mm • Shipping Weight: 1.1 kg

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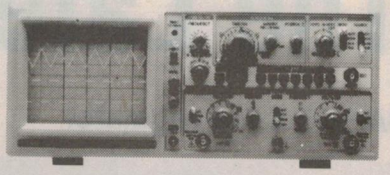
READER INFO NO. 25

GoldStar

9020G Scope with Built-In Function Generator

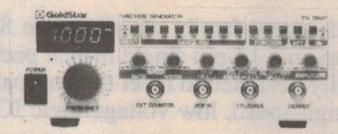
- 20MHz dual channel oscilloscope
- 7 range 1MHz function generator
- 1mV/ div sensitivity
- TV sync separator
- 0.2μs - 0.2s/div 19 range timebase
- Sine, triangle, square, TTL pulse outputs



$810*

Versatile FG-2002C Function Generator

- 0.02Hz to 2MHz frequency range
- Sine, triangle, square, ramp and pulse, sawtooth
- 4 digit LED frequency display
- <1% distortion from 10Hz to 100kHz



$495*

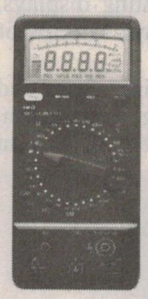
Also available FG8002 with similar specs but no display $395*

High Resolution FC-2130 Frequency Counter

- 0.2Hz to 1.3GHz
- Built-In CMOS gate array
- 8 digit green LED display
- Microprocessor controlled with self diagnosis
- Total, rpm and period functions
- Universal model for time intervals and ratios (FC-2130U)
- RS-232C interface option

Also available FC-2015 with 150MHz frequency range
FC2130 $495, FC-2015 $450, FC-2130U $595, FC-2015U $495

DM-332 4000 Count Multimeter



- 'Wrong position' protection on 10A range
- 40segment arc type analog bargraph
- Transistor hFE testing
- Frequency measurement 10Hz to 1MHz

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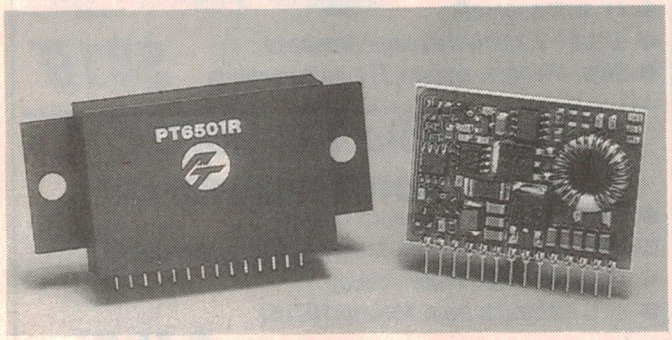
READER INFO NO. 26

Special Feature:

The Latest in Components

8A switching regulator



Power Trends has released a new family of adjustable 8A integrated switching regulators in a 14-pin single in-line package (SIP). They are specifically designed to meet the on-board power conversion needs of high speed, low voltage logic ICs, such as the Pentium processor.

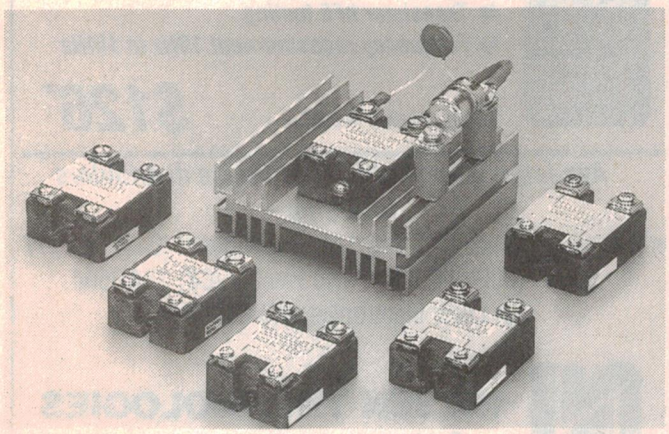
The PT6500 series provides power for low voltage logic ICs and bus terminating voltages from existing 5V supply rails, eliminating the need for total power supply redesign. The PT6501 provides 3.3V (adjustable from 2.5V to 3.6V), and the PT6502 gives 1.5V (adjustable from 1.5V to 2.5V), both at 8A. An operating frequency of 550kHz provides up to 90% efficiency, in a package size of 9 x 14 x 29mm.

For further information circle 201 on the reader service coupon or contact Alpha Kilo Services, PO Box 475, Artarmon 2066; phone (02) 901 3770.

Solid state relays

Fastron Technologies now carry an extensive range of Crydom solid state relays, suitable for process heating, motor control, vending and packaging machines, lighting displays, traffic control, medical equipment, fire and alarm systems or any application that requires high reliability.

Relays can be supplied complete with heatsink, fuses and over voltage protection, greatly simplifying installation. Single and three-phase assemblies are available in current ratings of up to 90A per phase and line voltages up to 480 volts AC.



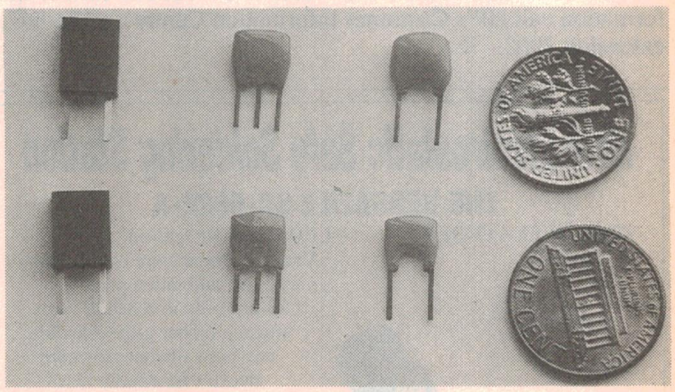
Fast cycle burst control and phase angle control firing modules can be used in conjunction with the solid state relays to give a simple and economical SCR power controller.

For further information circle 204 on the reader service coupon or contact Fastron Australia, PO Box 121, Dandenong 3175; phone (03) 794 5566.

Ceramic resonators for clock oscillators

Ceramic resonators with built-in capacitors are being increasingly used as clock oscillators for low cost embedded microcontrollers. Ceramic resonators now have a +/-0.3% frequency tolerance and are particularly suitable for low power battery applications. Physically similar to epoxy dipped ceramic capacitors, ceramic resonators are suitable for auto-insertion, flow solder and washable board assembly.

The Integrity Technology ZTS ceramic resonator series has a frequency range from two to 12MHz. Standard built-in



capacitor value is 30pF, and the start-up rise time is less than 100us. Operating temperature range is from -20°C to +80°C.

For further information contact Integrity Technology, 1400 Coleman Avenue, Santa Clara, CA 95050; phone (408) 262 8640.

Rugged photosensor

Datalogic has announced the S30 series of photoelectric sensors, claimed as one of the most versatile and industrially strong units currently available. Developed to meet the needs of the industrial automation sector, the S30 photocell is designed for industrial operation even under the most extreme conditions.

The photocell can auto diagnose its operating conditions, allowing real time monitoring and testing should performance be reduced due to dirt on the lens or misalignment. Built into a sturdy fibreglass reinforced plastic housing, the sensor has low susceptibility to electromagnetic inteference and has a variety of electronic functions.

The S30 series are all equipped with sensitivity controls, dark/light selection, and to facilitate installation, a LED stability indicator and two output logic status LEDs. The sen-

sors are suitable for conveyor systems, packing and wrapping, stacking, transport despatch, and so on.

For further information circle 202 on the reader service coupon or contact Datalogic Australia, 30/45 Gilby Road, Mount Waverley 3149; phone (03) 558 9299.

ISDN isolation transformer

The ETALP2880 is a microprofile transformer for applications where safety critical isolation is required. It features fully vacuum encapsulated construction, using materials conforming to UL94V-O flammability requirements.

The transformer is designed specifically for ISDN interfaces complying with the CCITT 1.430 basic rate requirements. The pulse and signal balance requirements of 1.430 are easily realised due to the low leakage inductance and coupling capacitances. The design is exceptionally compact and fully compliant with the safety requirements of EN 60 950 for isolation at 250V RMS. Austel certification is pending.

For further information circle 203 on the reader service coupon or contact Zatek, PO Box 397, West Ryde 2114; phone (02) 874 0122.

Compact DC/DC converter

Vicor's Mega/Master family of chassis mount DC/DC converters, which includes full size 50 to 200 watt converters (VI-200) has been augmented by the addition of a junior line of half size converters (VI-J00).

The new junior modules, which deliver 25 to 300 watts, are available in single, dual and triple output configurations that measure 15.7mm high, 65.5mm long and either 63.5, 124.5 or 185.9mm wide, respectively.

Also available in the junior size chassis mount package are a number of accessory components. The VI-AIM module features line rectification, EMI-RFI filtering, transient protection and inrush limiting, and the VI-IAM module provides EMI/RFI filtering and transient protection for industrial and telecommunications applications. The VI-RAM module limits total output ripple to less than 3mV peak to peak for VI-200 converters, and 10mV for VI-J00 converters. These product packages measure 65.5 x 63.5 x 15.7mm.

For further information circle 205 on the reader service coupon or contact Powerbox Australia, 1/38 Leighton Place, Hornsby 2077; phone (02) 476 4211.

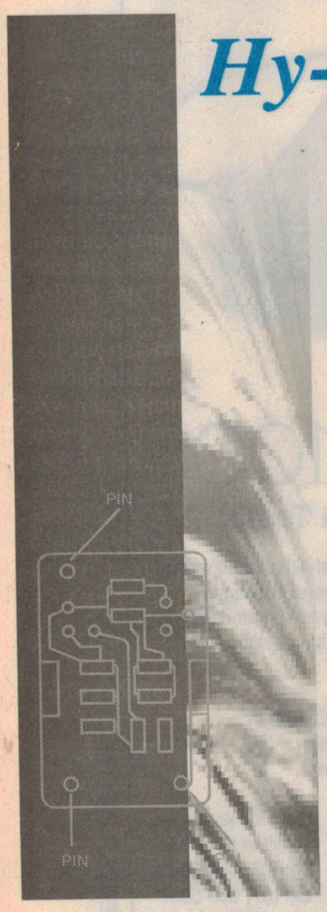
Rotary actuator

Ultimag, the new Ledex, high speed, high torque rotary actuator from Lucas Control Systems can achieve over 100Hz over its full stroke, and peak torque to 0.7Nm. With a relatively small package size (49.3mm diameter by 33.3mm), they are suited for office automation, automotive, defence and medical applications.

Ultimag offers a 3dB closed loop frequency response rating of 66Hz, but can be run well over 100Hz. With a life in excess of 100 million actuations, suitable for both on-off and proportional positioning, it is available for two, three or four pole designs for optimal stroke and torque.

The standard model provides strokes to 45° but longer stroke models can be provided. Featuring bi-directional actuation in a single coil design, it is magnetically biased towards the centre of a stroke when the power supply is off. Other features and options include internal end-of-stroke stops, magnetic latching at one or both ends of travel, customised stroke limiting and a spring for bias at either end of the stroke.

For further information contact Lucas Control Systems Products, PO Box 57, Bingley, West Yorkshire, BD21 5EF, UK; phone (01535) 661144.



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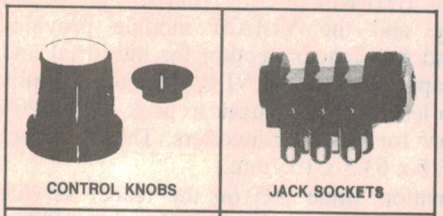
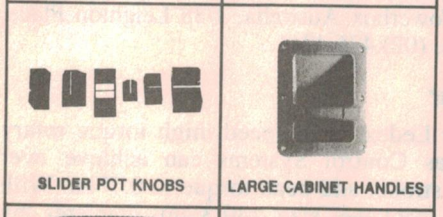

CONTROL KNOBS

JACK SOCKETS


SLIDER POT KNOBS

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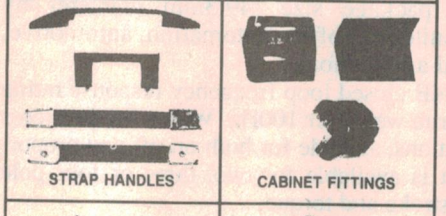
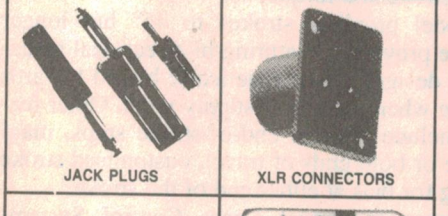

STRAP HANDLES

CABINET FITTINGS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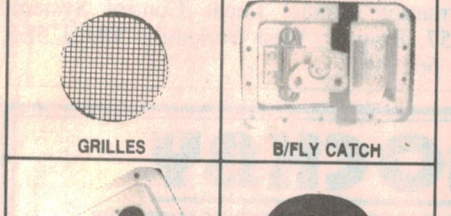
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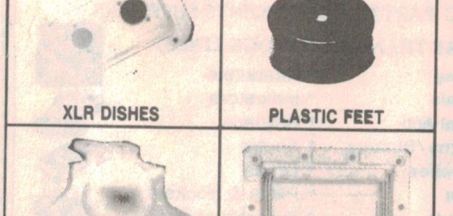
B/FLY CATCH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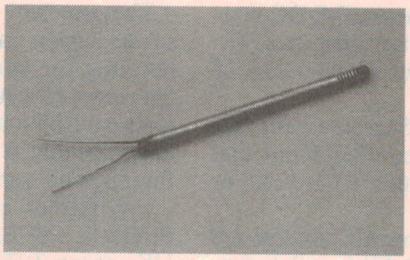
READER INFO NO. 29

Patented spring switch

Melbourne inventor John G. Haw has successfully patented a novel low cost component which can be made to perform the functions of a flexible switch, variable resistor/potentiometer or variable capacitor, depending on the materials and construction used.

Consisting essentially of an outer spiral spring element with specially profiled tension-compression characteristics, plus an inner co-axial conductor under tension, the component can be made at relatively low cost, in almost any desired size from subminiature to large. With suitable materials it can operate as a flexible, low-bounce switching element, capable of detecting deflections as low as 1-2° and switching currents of as high as 20mA indefinitely.



The internal wiping action makes the switch largely self-cleaning, and tolerant of relatively hostile environments. Needless to say, the switch itself can be used to control the conduction of a power transistor, power MOSFET, or triac device if higher currents need to be switched.

By using a resistive wire for the spring element, the component can be changed from a switch into a variable resistor, or even a potentiometer for sensing movement of various kinds.

The use of multiple internal conductors also allows either the switch or variable resistor versions to be given direction-sensing characteristics. Alternatively by using an insulated inner conductor, the component can be used as a variable capacitor.

Expected applications for the new component include inertia and tilt switches, limit and safety switches, sensors to allow disabled people to control equipment, joysticks and 'virtual reality' gloves, feedback sensing in automotive systems, robotics and biological experimentation.

Further information is available from inventor John Haw at 152 Nott Street, South Melbourne 3207; phone (03) 646 2988.

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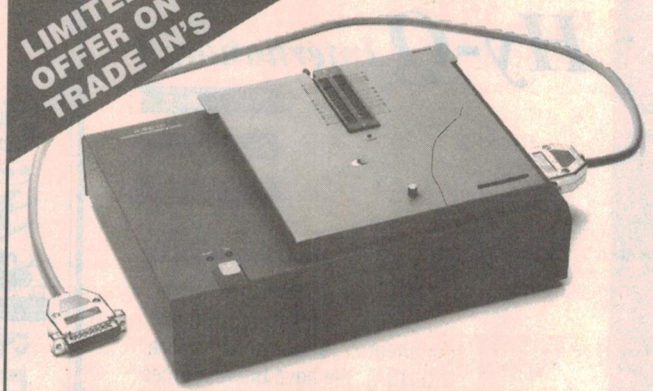

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READER INFO NO. 30

Flexible DC/DC supply

The DC MegaPAC is the newest member of Cicor's MegaPAC family of field configurable, single or multiple output switchers. Featuring eight slots for slide-in ConverterPAC output assemblies which incorporate Vicor DC/DC converters, the new MegaPAC provides from one to 16 outputs and up to 1600 watts of power. It measures 30 x 15.24 x 8.64cm.

The DC MegaPAC is initially configured at the factory according to user specifications, but can be easily reconfigured in the field as needs change. The number of outputs and their individual voltage and power levels can be configured in an almost infinite number of combinations. High current arrays of up to 320 amperes are possible. ConverterPAC assemblies are quickly replaced by loosening a crew, sliding out the old assembly, and sliding in the new one.

For further information circle 230 on the reader service coupon or contact Powerbox Australia, 1/38 Leighton Place, Hornsby 2077; phone (02) 476 4211.

10A TO-22 Schottky diodes

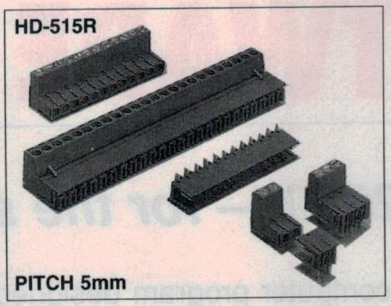
Taiwan Semiconductor Co (TSC) now has available a 10A IF (av) forward current device in the popular TO-220 package, to compliment its existing range of Shcottkey diodes.

The devices feature 'guard ring' for stress protection, guaranteed reverse avalanche protection, high surge capability, with low forward voltage drop with low power loss and high efficiency. They are available from 30V to 60V Vrrm and come as either common cathode, common anode or doubler configurations.

For further information circle 231 on the reader service coupon or contact GEC Electronics Division, 38 South Street, Rydalmere 2116; phone (02) 638 1888. ❖

TERMINAL BLOCKS

HD-515R



PITCH 5mm

Body Material:
Thermoplastic (UL 94V-O), green
Terminals Pin:
Tin plated brass available in interlocking two (2) and three (3) pole
Choice of right angle or vertical

Disconnectable two-piece construction simplifies field maintenance.
**** Choice of parallel or perpendicular wiring.***
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READER INFO NO. 31

SPOTLIGHT ON SOFTWARE

Jobsheet 2000 — for the serviceman

We look here at a computer program designed especially for a small to medium sized electronic servicing and repair business. Written in Australia, *Jobsheet 2000* has been designed by the owner of a repair business and has been in constant use by its developer for over five years. Here's what we thought of the latest version...

by PETER PHILLIPS

These days most commercial enterprises use computer software to run at least some aspects of the business. Off-the-shelf software includes a range of accounting packages and database style programs for stock control. But if you want software specially for *your* business then you're probably out of luck, unless you know someone who can write a program that suits your needs. And that's how this program came about.

The program being reviewed here will interest anyone running a servicing and repair business, particularly in the electronics service industry.

Called *Jobsheet 2000*, the package does virtually everything a small or large servicing organisation needs for efficient operation.

The program is DOS based, and can run on virtually any IBM compatible computer. In fact the hardware needs are quite basic: a '286/386/486 computer with a hard drive and a floppy drive. A basic colour monitor and a printer complete the requirement.

Overview

The program is designed to hold information on current and past repair jobs, spare parts, circuit diagrams, customers, orders, the performance of each technician employed by the business and the overall performance of the business. The idea is to operate the program in the reception area, so a customer enquiry can be dealt with, invoices can be dispensed and so on.

Perhaps the easiest way to describe the program is to present a sequence all service people are familiar with: from a customer entering the shop to reconciliation at the end of the day.

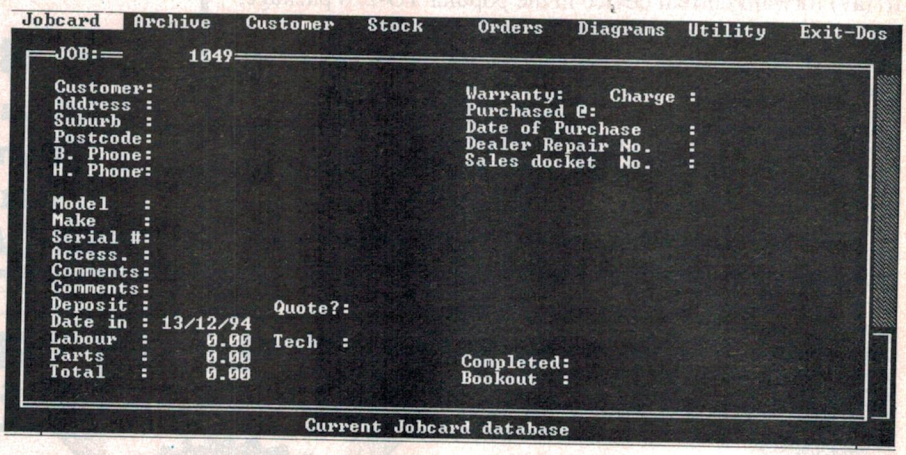


Fig.1: This screen shot shows a blank job card. The date is automatically entered when the file is opened. A customer printout is derived from this screen.

When a customer comes in with a repair job, you either call up their name if they're an existing customer, otherwise you start a new file. If an existing file, the screen shows basic details, including the last job and relevant phone numbers. To see previous jobs, enter either the job number (shown on the screen), a phone number or the customer's surname. Each job appears as a separate file.

Job sheet

A blank job sheet, as displayed on the

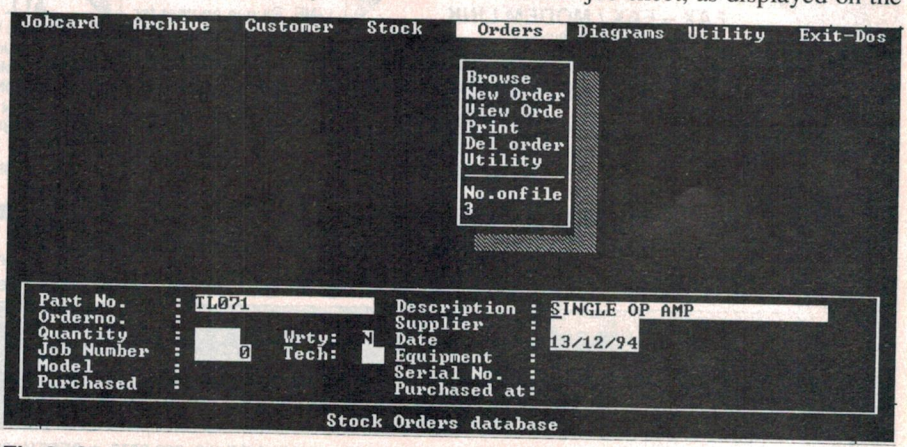


Fig.2: Ordering parts or components is partly automated by Jobsheet 2000. The only entry we made was to specify a TL071, the program did the rest.

screen is shown in Fig.1. Entering the model number of the equipment lets you check if there's a circuit in stock for the equipment to be serviced. If not, one can be ordered and the customer advised of any likely delay.

If there are accessories with the appliance to be repaired, these can be recorded for eventual return to the customer. These are also printed on the customer invoice.

The date is automatically logged onto the job card. Other entries include details of any deposit paid, or if a quote is required.

Once the job is logged in, a printout is then given to the customer. This can include minimum and maximum charges authorised by the customer's signature, before the job is handed over.

Categories

Once the job sheet has been generated, it automatically goes into one of two categories: quote or unfinished. This means when you select NEXT JOB from the screen menu, all those in the unfinished (U) or quote (Q) category come up first on the list. This allows a first-in first-out process.

The other categories are: P for parts waiting, W for in workshop, F for finished. For example, if parts are needed for a tuner, model XYZ, you call up the model number via the status menu and enter the parts to be ordered for that model.

The program allows all steps of the job to be entered, and the status of a job is automatically updated as various events are completed. For instance, if parts are needed, these are ordered through the system, with the status of the order automatically transferred to the job card. This allows any member of staff to intelligently answer a customer enquiry.

Ordering parts is also automated as far as possible. For instance, as shown in Fig.2, a part like a TL071 automatically comes up as a single op-amp.

The program is intended to be used by all those working in the business. Each technician enters details such as parts ordered, parts arrived, circuit ordered or arrived and so on. As well, the time spent on a job is entered. And it's this feature that allows the program to keep a running record of the performance of each technician, and of the business in general.

Utilities

Space doesn't permit us to go into all the details of this very versatile program. However the screen display in Fig.3 gives you an idea of what the system can do.

Under TECH SYSTEM, from the UTILITIES menu, virtually all aspects of the performance of the business can be viewed. The individual performance of each technician working for the business can be shown either as a daily, weekly or quarterly report. Here the hours worked and the gross income earned by a technician are shown.

At the end of each day, a reconciliation can be done which shows how much money should be in the till. At the end of each year, a more comprehensive reconciliation can be done.

Using the program

An important question about any program is how easy it is to use. These days many computer users tend to regard software that runs under DOS as being harder to drive than Windows-based software.

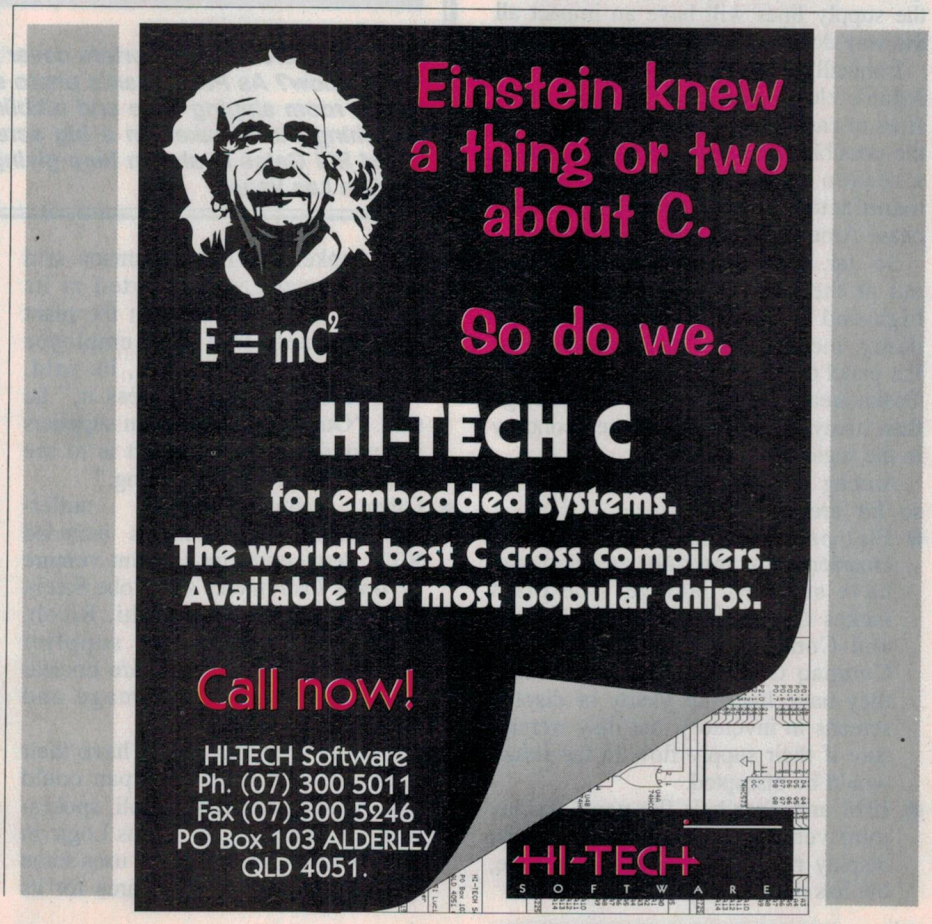
Although it's a DOS-based program, *Jobsheet 2000* is intuitive and quite easy to use. Obviously software this complex can't be learnt in five minutes, but we found it easy to get into the program and we soon had a good feel for it.

There are no weird keystrokes, and the 'escape' or 'enter' keys steer you virtually anywhere. There's no need to install a special printer; just hook up a basic printer to parallel port 1 and you're away.

The manual with the program is a mere 26 pages, but it seems to cover everything. It doesn't attempt to tell you how to run your business, but simply explains what the software does and how to make it do the job. And it's obvious from the writing style that the manual is written by a technician, for other technicians. It makes you feel quite at home!

In most cases, it will probably take about an hour or so to become sufficiently familiar with the program to be able to start using it. Thereafter, the benefits will flow. Apart from making the business look more professional, the efficiency of the business can be seen, and poorly performing areas attended to. And these days, efficiency is surely the buzz word.

Jobsheet 2000 is available in two versions: stand-alone which costs $695, and a networked version for $1190. Preprinted invoices cost $110 per thousand. The program is available from Sutherland Shire Electronic Services, 381 Port Hacking Road, Caringbah 2229, phone (02) 540 2611. ❖



Silicon Valley NEWSLETTER

Kobe quake will hit chip supplies

Silicon Valley computer and electronics manufacturers — and ultimately consumers — will be impacted by the devastation of the Kobe earthquake in Japan, as the disaster will cause a disruption of supplies throughout the electronics industry 'food chain'.

Some memory chip and computer screen manufacturers — ranging from Mitsubishi Electric to IBM — suffered direct damage in the Kobe area, and it's not clear if undamaged plants will be able to ship their goods for some time. Roads and train tracks leading to the quake area could take months to repair, causing delays or higher shipping costs for anyone trying to ship semiconductors and other parts.

In an economy built on the principle of 'just in time delivery', any disruption in the supply lines will have an impact all the way down to the consumer level.

Ironically, only three years ago, it was Japan's electronics industry which cited fears of earthquakes in Silicon Valley and the possible disruption in supply lines, as a reason why Japanese electronics manufacturers were unwilling to purchase American-built semiconductors.

So far, however, the initial reports out of the Kobe area indicate that the high-end electronics components industry, including the semiconductor and flat panel display operations in the Kobe-Osaka area have suffered far less damage than many other sectors of the economy in the region.

Among the things that are known so far are:

- Flat-panel display factories from Hosiden are in the Kobe area and may have suffered damage. The plant makes displays for Apple Computer and Compaq. Representatives for Compaq Computer and Apple said they have lined up plenty of display screens in inventory, but they weren't sure if their supply flow in the future would be disrupted.
- IBM and Toshiba's flat panel display joint venture is based in Kobe. The display plant suffered minor damage, but has not yet reopened.
- IBM spokesman David Samson said minor damage was reported at its memory plant in Yasu, but the plant has reopened. One IBM employee was killed in the quake, he said. "We're still trying to assess it," he said. "Our information from suppliers is limited. Our main effort is to see how our employees are doing."
- Other chip makers suffering damage or shutdowns included KTI Semiconductor (a joint venture of Texas Instruments and Kobe Steel), NEC, Toshiba, Mitsubishi, Ricoh, Matsushita and wafer supplier Sumitomo Sitix. Reports are unclear about the extent of damage and reopening schedules.
- US-based chip firms who have their chips manufactured in Japan could also be affected. Tom Rigoli, spokesman for chip designer Cirrus Logic in Fremont, said the company uses some chip makers in the Kobe area for its chips, but he wasn't sure yet if the suppliers were seriously affected.

Ever wondered how reporters cover all of those speeches at a major US trade show? As Paul Swart's photo shows, they sit in the comfort of the press room sipping wine and nibbling on chocolate chip cookies while watching the speaker on a big screen TV and taking notes. Microsoft head Bill Gates is shown here giving the keynote address at the recent CES in Las Vegas.

Hackers compromise Internet security

Authorities in California have revealed that a potentially devastating security breach of the Internet network which took place during the recent Christmas holidays has given a group of hackers the tools necessary to render virtually any computer connected to the Internet defenceless against intruders.

According to police reports, at about 2pm on Christmas Day, hackers attacked the computer system of Tsutomu Shimomura at the San Diego Supercomputer Center. Shimomura is regarded as one of the world's foremost experts on Internet computer security.

For the next 28 hours, they stole up to 20,000 computer files related to computer security, including many exotic

programs designed to protect computer systems from security breaches.

Industry experts have just begun to grasp what the hackers may have stolen — and what they could do with it. It now appears clear the thieves escaped with the tools to breach the security systems of countless computer systems around the world.

Copies of some of the files have already turned up on computers at Loyola University in Chicago and at the University of Rochester in New York. The security of Rochester's computer system appears to have been breached by the same hackers.

The information stolen from Shimomura's computer has given the intruders techniques for breaking into systems that are far more sophisticated than ones typically used by hackers, said Shimomura, who has not yet released a full inventory of what was taken. "I think they were after tools that I have or knowledge that I have," he said.

Shimomura had a huge electronic library, including unpublished software and correspondence that detailed gaping holes in the Internet's security. "I don't even want to think about what they got," said Jim Settle, former head of the FBI's computer crimes squad and now a computer security consultant with I-NET in Bethesda, Md. "He's got a mind that everybody in the computer security trade knows is one of the best. That's the reason he is a good target to go after."

In the days following their attack, the hackers left voice-mail messages for Shimomura, including a death threat.

The attack occurred while Shimomura was skiing at Lake Tahoe. A graduate student at the supercomputer centre noticed that some of the computer's log files had been altered and notified Shimomura, who rushed home.

The impact of the breach is potentially immense. Now that the weaknesses in the Internet's security have been exposed to criminal elements, the incident may greatly alter or slow the development of commercial activity on the net, as businesses and customers alike may be reluctant to entrust the Internet with information, including bank and credit card accounts that could be accessed by criminals to siphon money from the potentially vast flow of electronic currency.

Among the files that were taken was work Shimomura had performed for a cellular phone company, to increase the security of cellular phones. The cellular telephone industry estimates that fraudulent calls cost it more than US$1 million a day.

Sony ready to battle over DVD

Michael Schulhof, president of Sony's US operations, said that while his company is willing to negotiate with Toshiba for an agreement on a single new Digital Video Disc (DVD) standard, his company is prepared to enter into an all-out war over the format — which has the potential of rendering the video cassette industry obsolete.

"We would like to see a single format," said Schulhof. "That doesn't mean it's going to happen."

China gives in to US copyright demand

The Chinese government appears to have given in to US demands that the country curtails the rampant counterfeiting of Western personal computer software. Just one week before the February 4 deadline to avoid US sanctions, the Beijing government issued a decree mandating that any firm that publishes foreign recordings must re-register starting February 1, and show valid contracts with the copyright owners or face fines and other punishment.

The edict appears to lay the legal groundwork for long-awaited raids on up to 30 major counterfeit centres in southern China. Beijing officials also vowed to launch a sweeping anti-piracy campaign across China, in the first days of the Lunar New Year.

US officials and industry leaders say the bootleg plants, some state owned, are flooding Asia with illegal copies of US software, music and films worth hundreds of millions of dollars.

The United States had threatened to slap crippling tariffs on US$2.8 billion on Chinese exports after February 4, if China failed to show earnest efforts to combat piracy.

Schulhof said his company realises that another battle like Beta/VHS would slow the development of movie CD players, the first of which were shown in Las Vegas in January by Sony and its partner, Philips. The discs store 4.4 gigabytes of data, enough for a 135-minute movie. The Toshiba alternative stores slightly more data (4.8GB), requiring less compression and thus delivering even higher quality pictures.

Much of the film industry has expressed support for the Toshiba format, which is also supported by Matsushita and the other companies that may be producing DVD players. If the two sides can't find a way to settle their differences, Schulhof and other Sony officials said, Sony and Philips Electronics NV are perfectly willing to push the format they co-developed.

"Sony has always felt comfortable" with the idea of pushing its own format, said Jakob Schmuckli, chairman and chief executive of Sony's European unit.

A compromise may be difficult to achieve. Both sides have publicly staked out seemingly firm positions, reducing the scope for a face-saving compromise. For instance, the technical differences between the two DVD formats are fairly stark. The Toshiba-developed disc can store information on both sides, while the Sony-Philips disc is single sided.

Schulhof suggested that Sony may try to make an end run around Hollywood executives who have endorsed the Toshiba-Matsushita format, by appealing to other members of the Hollywood creative community, including directors and producers.

Intel releases Pentium Overdrive chips

Intel Corporation has launched its long-awaited Pentium Overdrive Processor, giving older personal computers the revved-up performance of a Pentium.

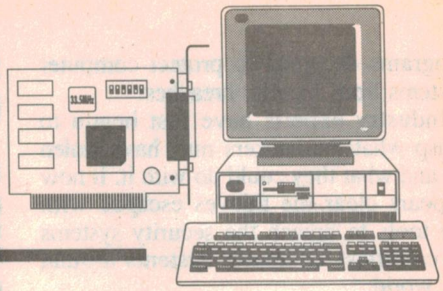
Two years behind schedule, the first Pentium Overdrive chip finally hit the US market on Monday, January 23, offering relief for about 56 million users of Intel 486-based PCs. With a US$449 Pentium upgrade chip, consumers can turn their obsolete machines into a respectable high-speed workhorse.

The first of the Pentium OverDrive chips operates at 63MHz. That would upgrade a 25MHz 486, a 50MHz 486DX2 or a 50MHz 486SX2 chip to Pentium speeds. With the 83MHz chip, which won't be available until later this year, a consumer could upgrade a 66MHz 486DX2 chip or a 33MHz 486DX chip. Overall performance could be improved fourfold, Intel said.

The upgrade microprocessor plugs into the same socket as the older 486 chip it replaces on a computer's motherboard.

The Pentium upgrade chip has been slow in coming because the company decided to wait for more advanced manufacturing technology and had to make sure that its design would be compatible with older machines. The early upgrade processor was considered too slow and ran too hot to be practical. ❖

Computer News and New Products

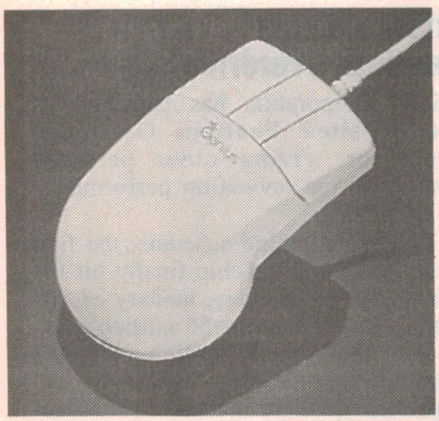


New shape mouse

Genius Australia has released a new range of ergonomically shaped mouse devices specifically designed to minimise wrist strain. The mouse is larger than previous models and suits both left and right handed users.

The Mouse 3 range includes the basic Mouse 3 model, which is bundled with MouseMate driver software including DOS and Windows mouse control panels, mouse drivers and a test program.

The top of the range is the Mouse 3 Plus. The price ranges from $26 for the basic Mouse 3 to $55 for the Mouse 3 Plus model with the extra software.



For further information circle 167 on the reader service coupon or contact Genius Australia, 4 Friar Court, Fulham Gardens 5024; phone (08) 235 2388.

CD-ROM recorder

The Philips CDD521, in conjunction with Windows based Win on CD Pro software, allows recording of CD-ROMs which can then be used on standard CD-ROM drives. The CDD521 conforms to CD-R Orange Book conventions and will also record CD-Audio and CD-I formats, and supports double speed recording and playback.

Up to 100 recording sessions per disc are allowed or until the disc is full. With a capacity of 630MB per disc, the system is especially useful for archiving applications. Connection with the PC is via a fast SCSI-2 interface. The CDD521 can be hired from Tech-Rentals.

For further information circle 165 on the reader service coupon or contact Tech-Rentals, PO Box 621, Ringwood 3134; phone (03) 879 2266.

Networking with GPIB capability

National Instrument's GPIB-ENET external interface kit is now available for PCs running Windows. Engineers and

scientists can use the GPIB-ENET to control GPIB instruments from driver equipped host Windows PCs, Macintosh computers, Hewlett-Packard 9000 series 700 workstations, or Sun SPARC stations anywhere on Internet, a world wide scientific, research, and educational network. Scientists and engineers can also use the GPIB-ENET to share peripherals between many networked users. For example, a user can control a GPIB system interfaced to a network by the GPIB-ENET from computers or workstations located within the same building or from another location in another state or country. The compact GPIB-ENET also

Ruggedised laptop

A new portable workstation from FieldWorks, model FW7500 complies with MIL spec 810C and is a ruggedised portable computer that uses the IBM '486 Blue Lightning 75MHz processor. It has an integral proprietary-design sealed mouse pad/cursor control, which can also be used as a signature pad (for job sign on/off) or as a graphics tablet.

The unit weighs 5.7kg, is 95mm high and is aimed at field use in engineering, medical, military, commercial and other applications. It is supplied with an integral universal power supply with 12V DC and mains AC input. Staggered ISA slots provide room for three full-size ISA cards, such as signal processing and data logging cards. The FW7500 structure is a die-cast magnesium alloy, and aluminium skins coated with high impact rubber provide high shock and vibration resistance, permitting reliable operation of the hard disk drive during 100G shocks. The unit comes with up to 64MB of RAM, a PCMCIA slot and a dual-scan colour LCD display. An optional integrated double-speed CD ROM is also available.

For further information circle on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood, 3066; phone (03) 419 9999.

has an internal power supply, and includes high level NI-488.2 software.

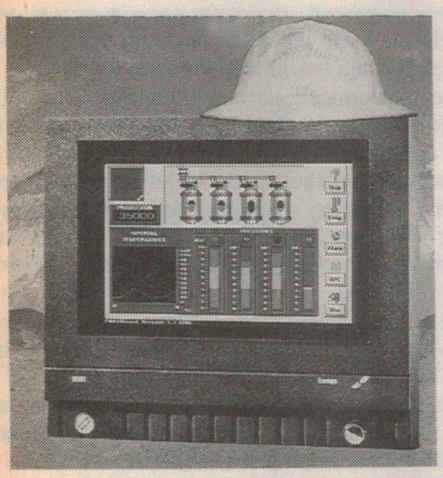
For further information circle 166 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 879 9422.

Sunlight readable VGA monitor

The new Deeco ST1230-SR sunlight readable VGA monitor from Lucas Control Systems Products is built to withstand the demands of outdoor and industrial environments. It is designed for round the clock viewing under harsh ambient light conditions, particularly direct sunlight or other forms of bright light.

The ST1230-SR features a backlit transflective LCD with 640 x 480 resolution and a 1:1 pixel aspect ratio. It is 100% VGA compatible and has a proprietary infrared touch system with mouse emulation.

Encased in a rugged aluminium enclosure, the monitor is sealed to meet NEMA 4 and 12 (IP65) standards. It



can be located up to 90 metres from the PC, without modification or the use of external line drivers if connected by coax cables. The monitor measures 127mm deep by 342mm wide and 323mm high, and the viewing and touch area is 196mm wide by 147mm high. The weight is 11.8kg, and the operating temperature range is from 0 to 45°C.

For further information circle 169 on the reader service coupon.

Simple EPROM emulator

The Sunshine Electronics EML-2M EPROM emulator is inexpensive, simple to use and saves time and money by eliminating the need to respectively program and erase EPROM's during development.

The EML-2M is capable of emulating one ROM/RAM from 64K bit to 2M bit, or two separate ROM/RAM's from 64K bit to 1M bit. The modular design allows for additional pods to emulate up to a single 8M bit ROM/RAM. The software included with the EML-2M can be in either hexadecimal or binary formats. There is also a full screen editor, which enables the user to edit the code in HEX or ASCII displays.

The software includes dissaemblers for the Z80, 8409, 8051, 8085, 6809 and 6811. The interface to the PC is through an eight bit card (SAC-101a) the same card as all HEP and most EXPRO series programmers.

For further information circle 180 on the reader service coupon or contact Baltec Systems, PO Box 107, Paddington 4064; phone (07) 369 5900.

Analog input card for PCs

Procon Technology has released an externally mounted analog input board for use with IBM compatible computers.

The ADC-808 provides eight analog inputs with 8-bit resolution and is available with 0 to 10 volt or 0 to 20mA input ranges. Other configurations are available on request. An industrial version, the ADC-808/I, is also available with 500 volt isolation between each analog input and detachable screw terminals for easy installation. Each board measures 240 x 100mm and can be DIN rail mounted.

A single interface card (PC-DB-IO) plugs into an 8-bit card slot and connects to 15 ADC-808 boards. This gives up to 120 analog inputs. Alternatively, the boards may be connected to any standard bi-directional printer port (available on most notebook computers), providing up to 56 analog inputs.

Typical applications include process monitoring and control, energy management, home automation, security systems and industrial control. Other boards are available in the range, including opto-isolated digital input and relay output boards. All are available with the industrial option and come with sample software for programming from most languages.

For further information circle 161 on the reader service coupon or contact Procon Technology, PO Box 655, Mount Waverley 3149; phone (03) 807 5660.

Pentium CPU board with PCI bus

The SB586TCP range of plug-in CPU boards from Industrial Computer Source has been released. These Pentium based CPU boards have been designed to bring PCI bus capabilities to single board

whats
NEW
Spectra Pro 3.0
Spectrum Analyser software - new professional version, now 2 channel, sig gen, cal files & more.
Demo disk $5, $569 upgrades avail
Imp MLS option is now available - fully built and tested - simply wire into your existing Imp, use version 2 software.
$195 + 21%tax (if app.)
updated
SSD PRO 4.25 Speaker System Designer
New Features, XYZ analysis, Import from LMS CLIO & IMP both Amplitude & Phase, Lattice Networks & more Demo disk $5
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CIRCUIT SIMULATION TOOLS
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32 BIT engine
* $49 creditable to later purchase of LITE or Interactive
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Dyers Crossing NSW 2429
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plug-in systems and come in two versions, the SB586TCP/60 and SB586TCP/66, based on the Intel Pentium 60MHz and 66MHz CPU's respectively.

The CPU cards are a single board PC that includes the floppy drive controller, both standard IDE Local Bus and PCI Local Bus SCSI-2 device controllers, two serial ports and a parallel port. The card has 256K cache RAM and will accept up to 128MB DRAM using 72-pin SIMMs.

The serial ports are 16550 compatible, while the parallel port is bi-directional Centronics compatible. The floppy drive controller supports two floppies; the IDE local bus controller will support two IDE drives. The SCSI-2 PCI local bus controller has drivers for DOS, Windows and OS/2. Additional features of the SB586TCP boards include a watchdog timer for critical industrial or commercial applications. The boards have an extremely high reliability rating (mean time between failure rate in excess of 90,000 hours), as well as a large operating temperature range of 0 - 60°C.

For further information circle 162 on the reader service coupon or contact Interworld Electronics and Computer Industries, 1000 Glenhuntly Road, Caulfield South 3162; phone (03) 563 5011.

Monitors from Hitachi

Signalling its intention to become a major player in the monitor market over the next 12 months, Hitachi Australia has announced an extended range of high resolution colour models. The move has been made possible through the development and implementation of a joint monitor strategy by two of the Hitachi Group of Companies in Australia, Hitachi Australia and Hitachi Sales Australia.

Top of Hitachi's current monitor line up are two 21" models. Both feature flat screens, offering 31 pre-sets and delivering 1600 x 1280 resolution at a refresh rate exceeding 72Hz. Sophisticated colour control systems with optimised ergonomics, advanced invar shadow mask and anti-glare technology combined with the sharp and flicker free image help reduce eye fatigue.

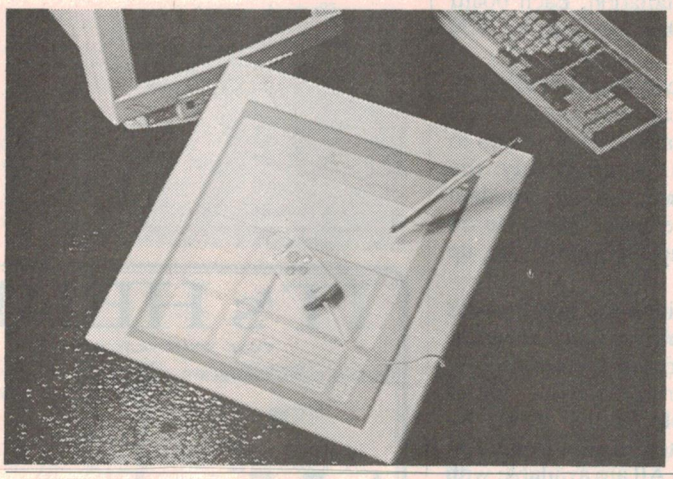
At the other end of the curent monitor offering is the 17" CM-1786ME. Designed as quality opposition to low end models, this entry level screen incorporates almost all of the high technology and user friendly features of larger monitors.

All Hitachi monitors feature digital controls, auto scanning capability and compatibility with PC, Apple Mac and UNIX workstation platforms. Fully compliant with the Swedish MPR-II low radiation standards, they are also designed to meet the strict guidelines of the EPA Energy Star programs as well as VESA DPMS power saving standard and NUTEK requirements to promote energy efficient computer equipment.

For further information circle 175 on the reader service coupon or contact Bernhard Kotarski at Hitachi Australia on (02) 929 8799 or Russell Stott at Hitachi Sales Australia on (03) 555 8722.

Digitiser tablets

The Genius NewSketh range of graphics tablets is designed for both Windows and DOS based PCs. With KeyCAD Complete for Windows and Advanced Utility for DOS software supplied with the digitisers, users are provided with a variety of user frinedly drawing, editing, design and viewing functions.



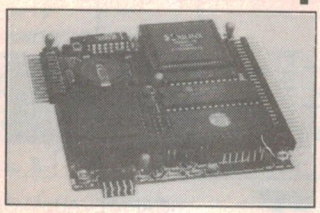
Users can produce mechanical anc manufacturing drawings, office layouts and flow charts. Its floating point coordinate system automatically calculates distance and dimensions. The software features a utility diskette for tablet operation and software applications including diagnosis and test programs. WINTAB driver for Windows, DOS Tablet Driver, ADI driver (Autodesk Driver Interface), mouse driver and mouse test program and emulation program.

The NewSketch 1212 has a 12" x 12" graphics tablet, with a four button puck which is interchangeable with a stylus.The retail price is $370. The NewSketch 1812 features a large 18" x 12" drafting surface with a durable tablet, puck and stylus for easy design. The 1812 also has a LED display to show the functions in use. The introductory retail price is $580.

The NewSketch range emulates Microsoft and Mouse Systems mouse modes. All digiters come with keyboard adaptor.

For further information circle 170 on the reader service coupon or contact Genius Australia, 4 Briar Court, Bulham Gardens 5024; phone (08) 235 2388. ❖

Australian Computers & Peripherals from JED... Call for data sheets.



Australia's first PC/104 computer.

The photo to the left shows the new JED PC540 single board computer for embedded scientific and industrial applications. This 3.6" by 3.8" board uses Intel's 80C188EB processor, with two serial ports (one with RS485), 3 timers, R-T-clock, I^2C bus, etc. We added a Xilinx gate array with 40 I/O lines for user I/O. It has 128 kB of RAM, and runs programs in C (using the $179 Pacific C complier). Or it can run Datalight's ROM-DOS from a 512 kB Am29F040 FLASH chip. **The basic board is $350 one-off.**

$125 PROM Eraser, complete with timer

$300 PC PROM Programmer.

(Sales tax exempt prices)

Need to programme PROMs from your PC?

This little box simply plugs into your PC or Laptop's parallel printer port and reads, writes and edits PROMs from 64Kb to 8Mb.
It does it quickly without needing any plug in cards.

JED Microprocessors Pty. Ltd
Office 7, 5/7 Chandler Road, Boronia, Vic., 3155. Phone: (03) 762 3588 Fax: (03) 762 5499

READER INFO NO. 36

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- *Long life 7mW/cm² tube*
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Australian designed and made and programs most popular EPROM's and FLASH proms. Just connect to the parallel/printer (Centronics) port of any IBM compatible computer using a DB25 connector and you can program 28 and 32 pin devices ranging from 2764 to 27080 and their derivatives. Ideal for use with lap-tops – no plug-in cards or complications. Programmer is completely hand-free. All controls are via the attached computer. Support software gives feedback of progress. Functions available include Blank check, verify EPROM to disk file, Auto ID, Read and Write EPROM to disk. EPROM contents can be viewed and single hex bytes altered. Operation can be either manual or automatic using the built-in ID mode of the EPROM to match the most efficient programming algorithm to the device. Requires only minimal memory as programming is done in "chunks".

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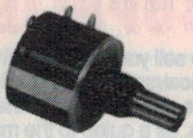

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Amtex Electronics 75
Bainbridge Marine 62
Baltec Systems 120
Campad Electronics 96/7
Circuitworks 43
Cliff Electronics 120
Delsound 31
Dick Smith Electronics 52-55
Don Alan Electronics 62
EA subscriptions offer 34
Electronic Dev. & Sales 117
Emona Instruments 103
Geoff Wood Electronics 129
Hinton Information Serv. 51
Hi-Tech Software 123
Hy-Q International 119
Icom Australia .....OBC
Jaycar Electronics 76-79
JED Microprocessors 128
Kalex 98
L.E.Boughen 121
L.E.Chapman 97
Leprechaun Software 99
Memory International 113
ME Technologies 127
National Communications 121
Nilsen Technologies 115,117
Obiat 13
Ocean Controls 51
Peter Lacey Services 44
Procon Technology 22
Protel Technology 12
Reg Mills Stereo 96/7
RCS Radio 96/7
Rockby Electronics 119
Rod Irving Electronics 63-67
Scientific Devices 19
Securicode 98
Technical Applications 47
TECS Wholesale .....IBC
Tektronix Australia 25
Tortech 96/7
Vintage Wireless Radio Co 103
Vorlac 51

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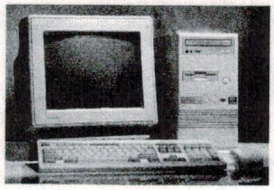

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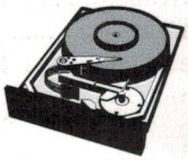

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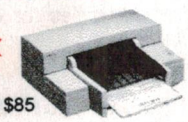

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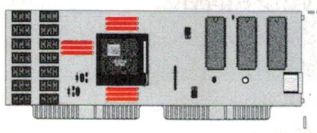

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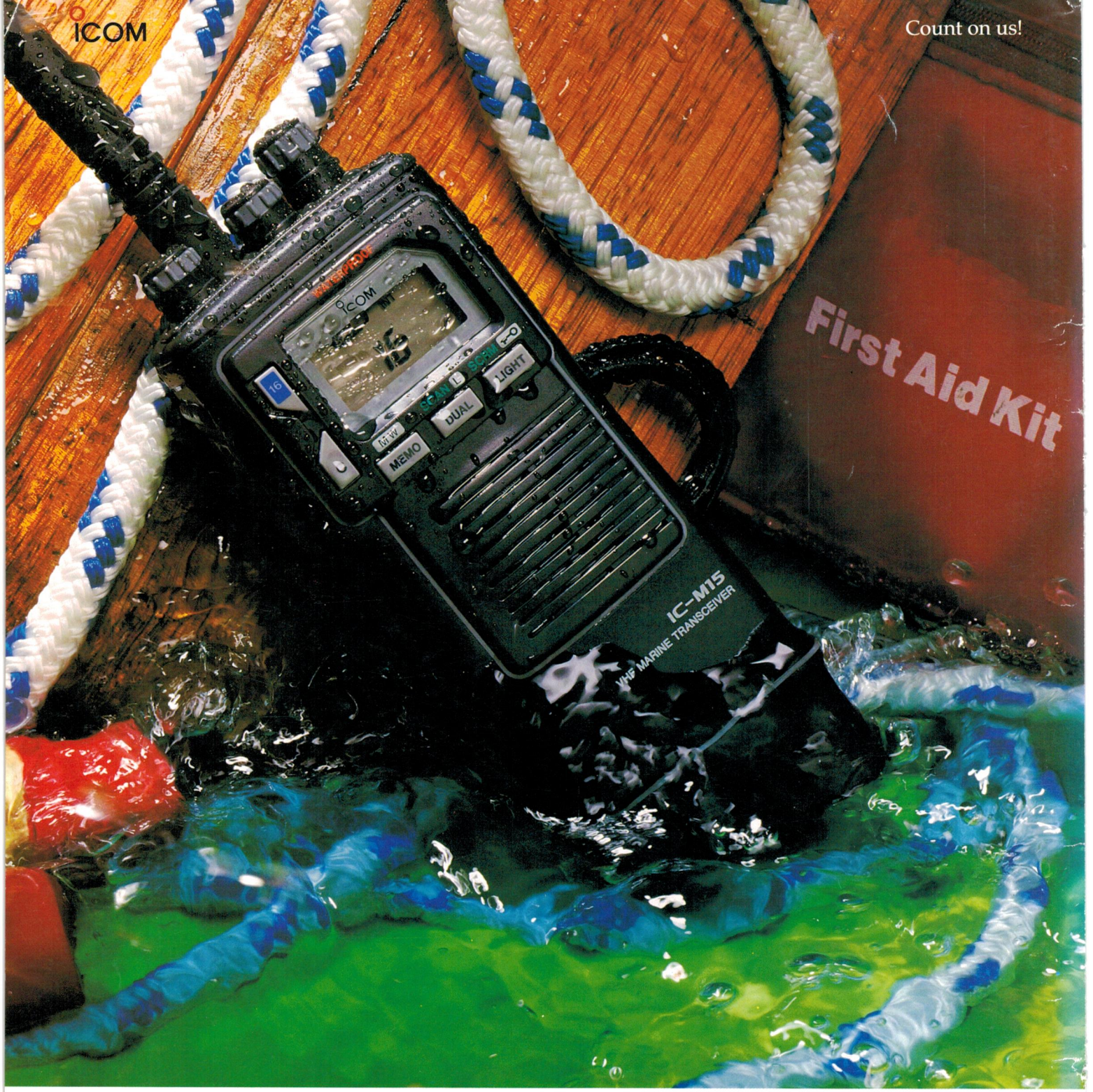

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AUTOMOTIVE ELECTRONICS

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Using a scope for vehicle faultfinding

This month we start the first of a short series of articles discussing the way an oscilloscope — of either the dedicated 'automotive' type or a standard electronics lab type — can be used for faultfinding and diagnosis in modern vehicles. A scope can tell you a great deal about what's going on in a vehicle system, once you understand how it's used.

In my travels around the workshops of the South Eastern states, I have often come across the perception that a 'lab scope' is going to be the piece of equipment that will help get 'the lads' out of trouble with vehicle electronics. Why then, I wonder, don't I see a proliferation of these readily available, low cost oscilloscopes, adorning the shelves of garages everywhere?

With entry level oscilloscopes weighing in at about the $700-$800 mark, there doesn't seem to be much price resistance. The biggest impediment to taking the step into oscilloscope land, it seems to me, is the steep learning curve associated with the somewhat awesome 'forest of knobs' that festoons the control panels of these alleged 'reputation saving' electronic gizmos.

What is needed, I think, is a simplified course specifically designed for the automotive technician. So over the next couple of months I hope to convey the benefits of using an oscilloscope, and at the same time provide the basis of a working knowledge that applies to both dedicated automotive, and general purpose scopes.

A brief history

Back in the dim dark ages of automotive history, shortly after the oscilloscope had been invented, some farsighted visionary decided to make use of the technology in the automotive field. The first scopes employed valve technology, and were only capable of displaying the secondary side of the ignition; but it was a step in the right direction, and a new era in vehicle diagnostics was born.

By the way, despite 'evidence' to the contrary contained in scope training manuals and TAFE courses etc., spark plugs actually fire 'backwards' — i.e., electrons flow from the centre electrode to the 'ground' electrode, rather than the reverse. In other words, the HV pulse fed to the plugs is *negative* with respect to chassis. You can demonstrate this with the 'pencil test' shown in Fig.1, where the bright 'flash' is on the side of the pencil nearest the plug, where the electrons are leaving the graphite.

However it seems that a decision was taken in the beginning, with engine diagnostic scopes, to invert the scope's display of the secondary pulse so that it goes 'upward', in the same direction as the 'primary', as if it were a positive-going spike. This kept things nice and simple for the motor mechanics of yesteryear who, in the main, had little if any training in electricity — and would probably have gargantuan difficulties coping with the concept of a voltage of less than zero...

So automotive scopes traditionally invert the HV pulses, but of course a standard lab scope doesn't. Bear this in mind when you're interpreting the displays you get.

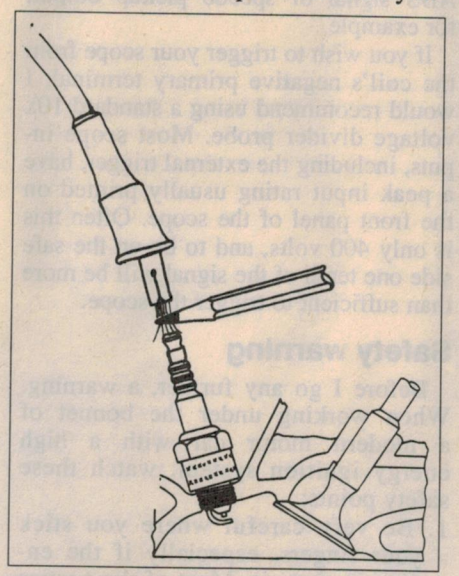

Fig.1: A simple test to demonstrate the polarity of the HV plug firing pulse — but DON't attempt doing it with a High Energy Ignition System!

Subsequent offerings included the ability to display primary ignition, alternator ripple and injector waveforms. More recently, vacuum pulsations have been made open to scrutiny, but very few automotive analog scopes have had the option of varying the timebase beyond a 150ms sweep length.

Some interesting display techniques have emerged over the years, such as rastered ignition traces (Fig.2A) that display each of the individual cylinder ignition cycles across the full width of the scope screen, in a 'ladder' type format. Another useful variation to the raster theme is the 'superimposed' format (Fig.2B), which is great for comparing voltage and timing discrepancies.

A few manufacturers have offered an individual cylinder 'liftout' option (Fig.2C), that expands the chosen cylinder's sweep to the full width, displayed at the top of the screen whilst leaving the others in the regular, externally triggered, 'parade' mode below (Fig.2D).

Most of these display techniques have become part of automotive folklore and have been around for so long that even the patents have lapsed. However the advent of digital scopes has brought a new angle to automotive troubleshooting.

Analog vs digital

There will always be a debate raging over which is best: analog because the inputs act directly on the guns of the picture tube, or digital because it's so much more powerful...

The 'purity' of analog versus the 'power' of digital seems to be quite a polarising dispute, with firmly

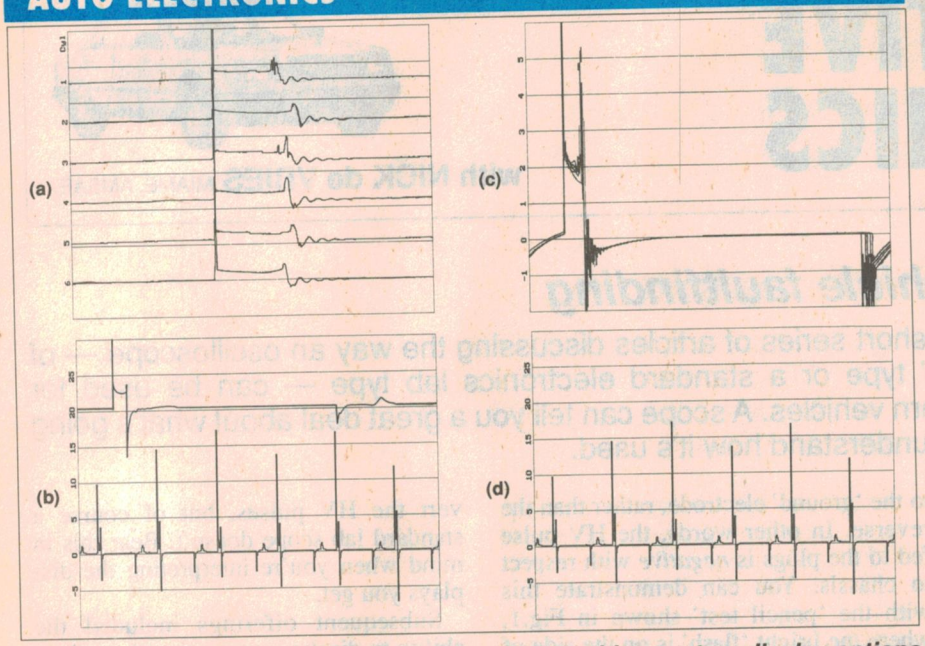

Fig.2: A brief pictorial summary of the various ignition system display options employed by automotive scope manufacturers.

entrenched opponents on each side. The argument, as I see it, is irrelevant, with the only criterion for making your equipment choice really being 'how much power do you need?'.

If you wish to impress your clients with a printout of 'before and after' waveforms, or need to have the facility of recording the waveforms for retrieval at some later date — or perhaps you want the ability to apply measuring cursors to resolve duty cycle, time, degrees, frequency, or voltage, then digital is clearly the only, if more expensive, choice. But if on the other hand, your budget doesn't stretch into the thousands, then there are quite a few low cost analog machines that will be suitable for the task, for under a 'grand'.

Triggering

As any electronics oscilloscope sales rep will confirm, triggering is one of the most important attributes of the scope. The quality of the triggering circuit largely determines the quality of the scope. After all, if it's not possible to achieve a stable display on the screen, then how can anyone analyse the circuit in question?

To use a regular scope in an automotive environment, it will be necessary to adapt the inputs in a similar fashion to an automotive scope. For example it is probably useful to have some extra probes for the 'external trigger' socket on the front panel of your scope.

The most common triggering probe is the ubiquitous 'No.1' probe, designed to pick up its signal safely from a plug lead, via capacitive coupling. These probes are commonly available from timing light manufacturers, and will need to be reterminated with a BNC fitting to match your scope, although I notice that Tektronix have one ready-made in their CAR200 set of test leads.

The No.1 probe allows you to capture on-screen any events that occur 'in synch' with the engine. It has no relevance of course when looking at an ABS signal or speedo pickup output, for example.

If you wish to trigger your scope from the coil's negative primary terminal, I would recommend using a standard 10x voltage divider probe. Most scope inputs, including the external trigger, have a peak input rating usually printed on the front panel of the scope. Often this is only 400 volts, and to be on the safe side one tenth of the signal will be more than sufficient to trigger the scope.

Safety warning

Before I go any further, a warning. When working under the bonnet of a modern motor car with a high energy ignition system, watch these safety points:

1. Be very careful where you stick your fingers, especially if the engine is running. Most of the nasties have an insulating cover, but when probing the negative side of the coil, for example, you will be exposed to about 300 to 500 volts at around seven amps! If you've got a 'dicky ticker', a few thousand watts of power aren't going to do it a lot of good; always use insulated probes. It's probably a good idea not to work alone,either.
2. Always work in a well-ventilated area. My *Bosch Automotive Handbook* tells me that 'Inhalation of 0.3% by volume of Carbon Monoxide can cause death within 30 minutes'.
3. Furthermore, nitrogen dioxide (that's the reddish brown gas you sometimes see spewing from the tailpipe of a rapidly accelerating vehicle) actually destroys lung tissue. I wouldn't like to think that my readership took a plunge because I didn't warn you of the consequences!

In preparing for this series of articles I have drawn heavily from workshop manuals, troubleshooting guides, operators' manuals and other sources too numerous to mention individually. As they say in literary circles, '...using one book is plagiarism; using half a dozen is research'!

Starting point

As a beginning point or entry level for this course, I'll start from the premise that you already have some understanding of oscilloscopes in general, and probably been exposed to the automotive tunescope (this is the automotive electronics column after all, right?). This means we can concentrate on what signals should look like, and how to make sense of the squiggly lines.

It's probably safe to say that the best way to know if a signal is faulty, is to know what a good signal looks like, (sounds a bit like the chicken and the egg story, doesn't it?) and this is the principle we will follow. We will start with input signals such as Hall effect sensors, and progress to output signals such as an idle speed controller, and touch on the interaction between the two groups.

Input signals

The input signals fall into two distinct categories, and several other blurred ones. Category number one we'll call Pulse Generators, and these consist of Hall sensors, reed switches, photo interrupters and variable reluctance sensors. The Ford MAP sensor can be included here as well because of its frequency output.

In category two we'll include all the Variable Voltage devices. These gadgets are generally not timing devices and include things like throttle position poten-

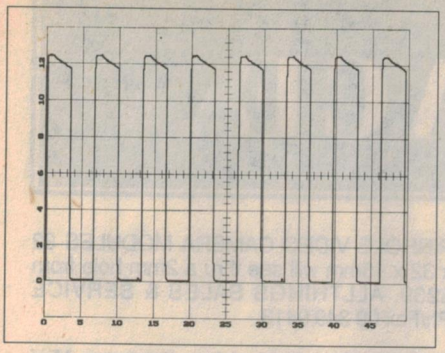

Fig.3: Rounded teeth equals rounded signal; if a Hall effect CP sensor sustains damage, look for this kind of distortion, or even missing segments.

tiometers, coolant temperature sensors, air flow/mass sensors and the like.

In the 'blurred' category we'll put things like the oxygen sensors and knock sensors that actually produce their own voltages.

I don't intend to make this a definitive work on what to expect from each and every sensor you may ever encounter. However once you are on your way with a few basic principles, it won't be long before you are confident with them all.

The first and most important input signal we'll look at is the coil negative signal. This input is so significant that in the Bosch numbering system it is designated '1', whereas battery positive is '30' and coil positive is designated '15'. Every ECU needs to know what phase the engine is in, and how fast it is spinning over. If the engine is fitted with a distributor and one ignition coil, then the coil negative is a convenient pickup point for engine speed.

To view this on your scope without a number 1 cylinder external trigger, simply trigger off the wave itself with the triggering switch on your scope set for the rising (positive-going) edge on the channel you are in. Vary the timebase from about 20ms per division to see the whole engine sequence, and down to 2ms/div for a close-up of the first event in the sequence. The only way I can think of to get a close-up of the other pulses in the engine's firing sequence, on a lab scope, is to use an external trigger and swap between spark plug leads.

The 'No.1' probe mentioned earlier is convenient because it simply clips over the outside of the plug wires, saving the operator from the dangers of electrocution. At a pinch you could try wrapping a few turns of wire around one plug lead at a time and connecting your external trigger scope probe to one end and the ground lead to the other. This is somewhat cumbersome and time consuming, but it's cheap and quite effective. Just be careful you don't exceed the input voltage limit of the scope, by winding on too many turns!

If you are using a digital scope you may notice in the 20ms/div setting that the peaks are sometimes missing from the firing pulses because the sampling rate has slowed down significantly. Since the firing spike is only a 20us event, it often falls between the sample points. To catch them all, turn on the 'peak detect' circuit and make sure the probe is grounded to eliminate as much of the noise as possible.

I can almost hear the analog crowd gloating about not needing a peak detect switch, and this is perfectly true. But the trace will be pretty faint on an analog screen; in fact many of the dedicated automotive scopes have a 'brightening' feature for the vertical spikes just to cope with this very problem.

The very best digital 'Tunescopes', such as the Autodiagnostics unit I reviewed in December's issue, have separate input channels for the Primary, Secondary and General-Purpose scope inputs, with some excellent filtering circuits to eliminate the enormous amount of electromagnetic noise in the underbonnet environment.

No distributor?

With an almost global move towards distributorless ignition systems (DIS), the coil negative pickup point is rapidly vanishing and other signals are needed as an engine speed input to the ECU. Once again if you have a clear grasp of the principle of operation, then it is relatively easy to spot the similarities between the different marques.

The first vehicle that we saw here in Australia with 'Direct Fire' ignition or DIS was the VN Commodore, with an economy version of the then current American Delco design. There are now too many makes and models to count with some form or other of DIS, from Audi to Volvo and just about everything in between. Almost invariably, each of the systems have two input signals from which the ECU derives engine speed and position, and the pickup points are usually attached to one end of the crankshaft.

The EF Ford released late last year, with the innovative Broadband Manifold six-cylinder engine, also features an electronic distributorless ignition designated EDIS. Strangely, the cylinder identification (CID) sensor is housed in what looks like the bottom half of the old ignition distributor (I thought

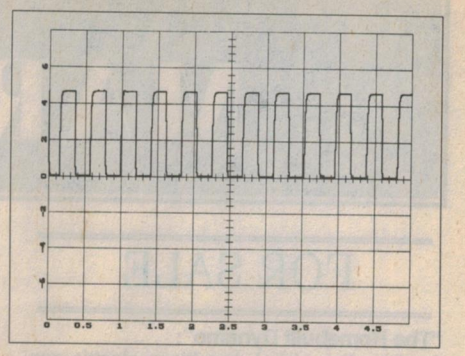

Fig.4: When checking a '360 degree' (one pulse per degree of rotation) signal like this one from a photodiode/slotted wheel sensor, you will need to remove your external trigger probe from cylinder to cylinder to work your way around and examine the pulses from all wheel segments. A digital scope with sufficient memory will be able to scroll through one full rotation with ease.

the whole idea of switching to DIS was to reduce the amount of moving parts?) The crank- shaft position (CP) sensor is located in the usual position at the front crankshaft pulley, where a toothed timing wheel has 35 teeth spaced evenly around the circumference at 10° intervals, with the 36th tooth missing.

The waveform shown in Fig.3 is from a Hall-effect CP sensor

Once a DIS engine has started the ECU doesn't need to refer to the CID signal again, when it's got the cylinder phasing sorted. It merely assumes that nothing has changed. If the CID signal is interrupted the engine will keep running, but won't restart after it is switched off.

Out here in the world of servicing and repairs some amusing (once they're found) faults are turning up. For instance the BMW approach is to use the starter motor ring gear for the crankshaft position signal, which I think is a sensible idea as it was there before electronics was ever considered for motor cars. However when the starter motor fails to fully mesh, over a long period of time, the subsequent wear and tear on the ring gear teeth presents a rather erratic signal to the ECU. Fig.3 shows the waveform from a Hall-effect CP sensor operating from worn ring-gear teeth; note the distorted waveshape.

Try finding that one on a Friday afternoon: "...We're going on holidays tonight, but the car's misfiring — can we have the car back at 4.30, please?" Just as well you had your scope handy, isn't it?

We'll continue with this topic next time. ❖

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C Compilers: Everything you need to develop C and ASM software for 68HC08, 6809, 68HC11, 68HC16, 8051/52, 8080/85, 8086 or 8096: $150.00 each. Marco Cross Assemblers for these CPUs + 6800/01/03/05 and 6502: $150 for the set. Debug monitors: $75 for the 6 CPUs all compilers, XASMs and monitors: $550. 8051/52 or 80C320 Simulator (fast): $75. Demo disk: $5.

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Digital Trigger Adapter for Scopes

Continued from page 85

PARTS LIST

Resistors

All 1/4 Watt, 5%:

R1-R8,R25-R32, R39	1k
R9-R24,R33,R36-R38	10k
R34	100k
R35	2.2k

Capacitors

C1	15nF MKT or met. polyester
C2	1nF NPO ceramic
C3	680pF NPO ceramic
C4	270pF NPO ceramic
C5	100pF NPO ceramic
C6	4.7pF NPO ceramic
C7	1uF 50VW RB electrolytic
C8, C11	0.1uF monolithic ceramic
C9	10nF NPO ceramic
C10	100uF 25VW electrolytic

Semiconductors

D1-9	1N4148 or 1N914 small signal diodes
D10	1N4002 power diode
Q1	BC548 NPN transistor
LED1	5mm orange LED
IC1, IC3	74HC86 quad EX-OR gate
IC2, IC4	74HC02 quad NOR gate
IC5	74HC30 eight input NAND gate
IC6	74HC32 quad OR gate
IC7	74LS123 dual retrig. monostable (see text)

Switches

SW1-SW8	SPDT centre off PC mount toggle switches
SW9	Two pole 6-position rotary switch
SW10	SPDT toggle switch

Miscellaneous

PC board 85 x 145mm, coded 95ta4; Plastic box to suit, size 50 x 90 x 150mm; 2 x 20mm knobs; 4 x AA cell battery holder; 8 x red IC test clips; 1 x black IC test clip; panel mount BNC socket; 5-pin panel mount DIN socket; mounting hardware; 40cm 12-core ribbon cable; tinned copper wire; molex pins; solder etc.

Drill eight holes in one end of the box for the input leads, and cut three larger holes in the other end for the DIN socket, BNC socket and the on/off switch. Use a 10cm piece of eight core ribbon cable to connect the DIN socket to the board, ensuring that every alternate wire in the cable is grounded in order to shield the slave inputs. Similarly, use a piece of three core cable to connect the BNC socket to the board, grounding the two outside lines.

The unit is powered by four AA cells, and the holder for these can now be secured to the bottom of the case and wired up to the on/off switch. The eight input leads can now be threaded through their respective holes and soldered to the board.

Don't forget the ground line, which connects to the board next to SW5. Solder nine IC test clips (eight red and one black) to the input leads and ground line. Keep the input leads as short as practical, as the capacitance of the leads will become significant at high frequencies. Finally, trim the pot and switch shafts, mount the knobs, and screw the lid onto the case.

Slave units

Up to two slave units can be 'daisy chained' to the main DTA, giving a total of 24 available inputs. As the master unit automatically detects any slaves connected and also supplies power to them, increasing the number of inputs is as simple as plugging in another unit.

While there is currently only provision for two slaves to be connected, there is no real reason why more couldn't be added in conjunction with a little thought and another 74HC32, to give as many inputs as required.

Construction of a slave unit is quite straightfoward, as the same PCB used for the master unit is used to the slaves. However in this case only the input section components shown in Fig.1 are fitted to the board — except for the supply decoupling capacitors C8 and C10, which should be installed along with all of the wire links.

A slave unit is connected to the main DTA by a short length of ribbon cable, terminated in a five pin DIN plug. The cable is wired so that every alternate line is connected to ground — see Fig.3 for the wiring details.

Using it

The completed DTA can be easily tested by setting one of the inputs to '1' with the remaining switches set to the centre position. By touching the active input lead with your finger, the trigger LED should light, indicating that the DTA is picking up stray 50Hz hum. This shows that the DTA's input section is detecting the hum and that the trigger pulses are being produced.

Due to the DTA's high input impedance, you should ensure that all unused input switches are set to the centre position in normal use, to prevent false triggering due to stray electrical noise.

That's about it, really. With this small addition to your test bench, you can now 'look inside' almost any piece of digital equipment, from a faulty flipflop to a problematic PC! ❖

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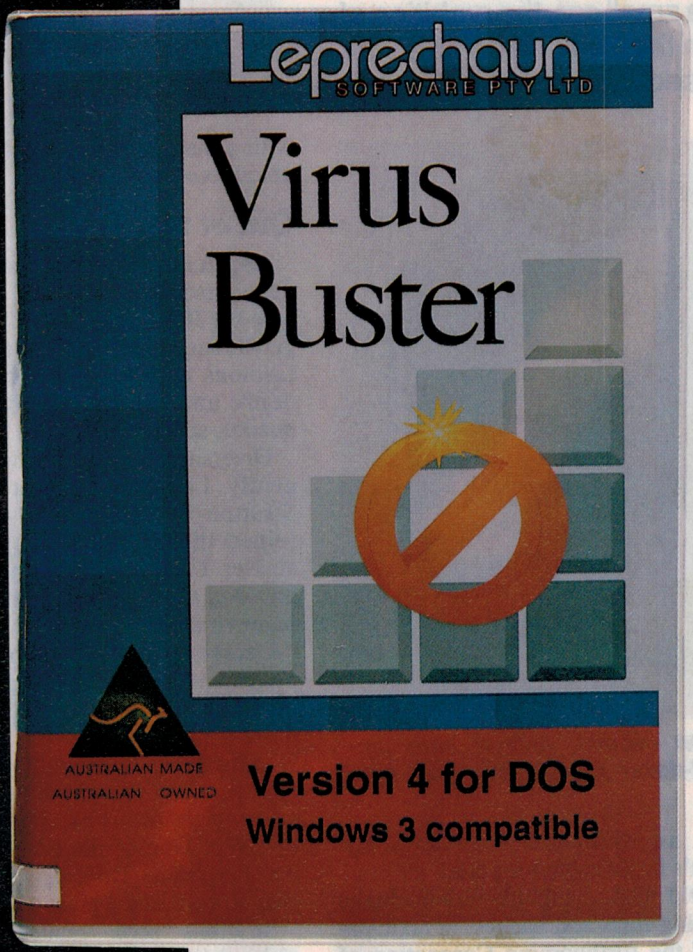

Virus Buster offers generic virus protection, making it effective against both known and unknown virus types. A special multiple check-sum method is used to monitor the integrity of files, while further utilities can write-protect a hard disk and restrict access to programs. Critical disk areas can be saved to a floppy for emergency disk recovery.

Virus Buster effectively removes viruses from infected files or disks. It can restore systems infected with a virus and 'clean' both hard disks and floppy diskettes.

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Vintage Radio

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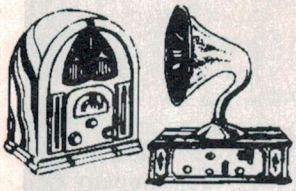
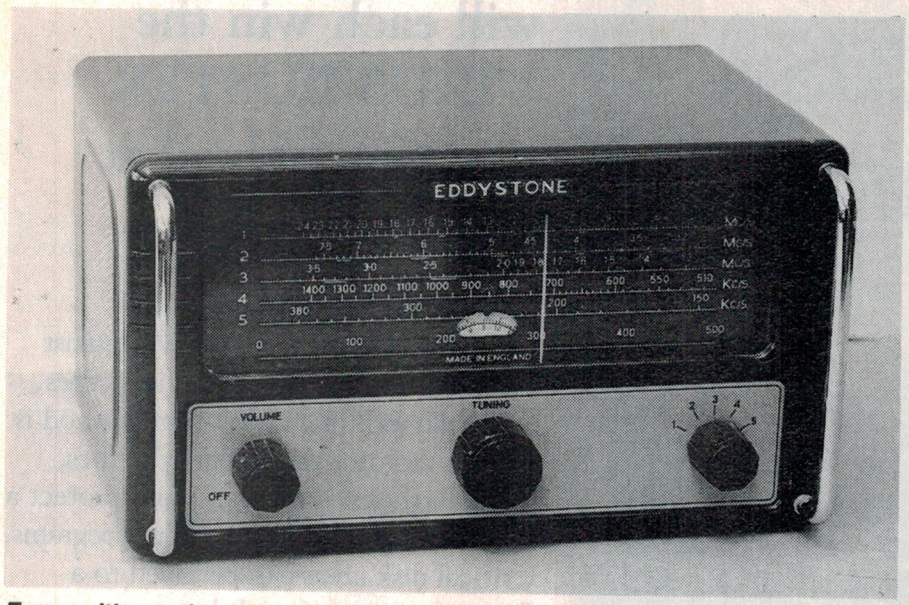


A miniature Eddystone

The name of Eddystone, of Birmingham in the UK, is synonymous with fine communications equipment. Before the Asian invasion of solid state receivers, and although the price might have gone a long way towards the buying of a small car, the ambition of many Australian and New Zealand amateurs and shortwave enthusiasts in the 1950's and 60's was to own an Eddystone communications receiver. Many that were purchased then are still giving good service today.



Even without the name badge the little 870A cabinet, only 280mm long, would be instantly recognisable as a scaled-down version of a full sized Eddystone receiver.

Eddystone Radio built their first radios more than 70 years ago, and their founding is a classic example of the way fashion and developments can completely alter the direction and product of long established companies.

It all started in 1860, when the partnership of Jarrett & Rainsford was founded in Birmingham to make pins and small metal components.

Thirty eight years later, in 1898 and coincidently, at the time when Marconi was founding his Wireless Telegraph company, J&R took on a likely office boy, one G.A. Laughton. Laughton displayed such ability that in 1904 he was made Assistant Manager of a new department, set up to make hair pins or as they were popularly called 'bobby pins', an essential accessory for women's fashionable long hair.

In 1911, G.A. Laughton was in charge of making flags and badges, in anticipation of the forthcoming Coronation of King George V.

The business of one of their key subcontractors was in a bad way, and deliveries very unreliable. Realising that there could be supply continuity problems ahead, Laughton, with his own money, bought out the ailing firm, renaming it 'Stratton & Co'. Shortly afterwards he was made a director of Jarrett & Rainsford, but continued to run the by-now thriving Stratton organisation.

In 1920, the two firms amalgamated to become Jarrett Rainsford & Laughton — making a wide range of household items, with a major emphasis still being on the ubiquitous bobby pin.

Out of fashion

Apparently unrelated events can alter the course of history, and such was the case for JR&L. No sooner had the amalgamation been completed than women's fashions changed. Long hair was suddenly unfashionable and as a consequence, so were long pins.

Diversification was called for — urgently. Laughton's eldest son, George Stratton Laughton, who had recently joined the organisation, provided the answer. Like many bright young fellows then and since, he had been bitten by the radio virus.

George suggested making radio components. The directors agreed, and in 1922 the Stratton plant was put to work making parts which were trade marked with the Eddystone lighthouse as a symbol of endurance and reliability.

Complete receivers were being made by 1923. One of the early models was the 'Eddystone Twin' having two valves, plug-in coils and a glass panel!

Strattons soon realised that their niche was in making shortwave equipment, and when the BBC commenced their shortwave transmissions, Eddystone receivers were the only available British-made radios capable of receiving the 'Empire' broadcasts. These receivers became very popular with expatriates in the far corners of the world, and with enthusiasts who appreciated *high quality equipment.*

Before long, there were contracts for government and commercial services, and Stratton-made equipment was carrying not only the Eddystone badge, but also prestige labels like STC, Marconi, BBC and Post Office. As well, military,

naval and merchant marine services have long been extensive users of Eddystone made equipment.

Today, with most communications receivers for non-commercial service coming from the Orient, the good news is that Eddystone are still very much in business. The company amalgamated with Marconi in 1965, and are still making professional equipment of the highest quality.

It was during the twenty years following 1950 that Eddystone receivers had their greatest popularity with amateurs and shortwave listeners. A glance through copies of *Radio and Hobbies* during this period will reveal advertisements for mouth watering Eddystone products, selected from a wide range of models. These range from top of the line professional receivers like the 680 and later the 940 (described in this column for March 1993), to more affordable but still high performance sets like the 640 and 750.

There were also their popular components, especially the tuning dial assemblies that were often used in amateur equipment.

Also it is not always realised that Stratton & Co originally developed the familiar diecast metal boxes, now locally made, that add distinction and convenience to small projects.

A cabin receiver

During 1957/58, a unique Eddystone receiver, the 870 was introduced. Whereas contemporary Stratton equipment was complex and relatively massive, the model 870 had only five valves and if judged only by its circuit, was simply a modest transformerless AC/DC receiver, with much in common with millions of low priced radios intended as second sets, or for bedside and apartment use.

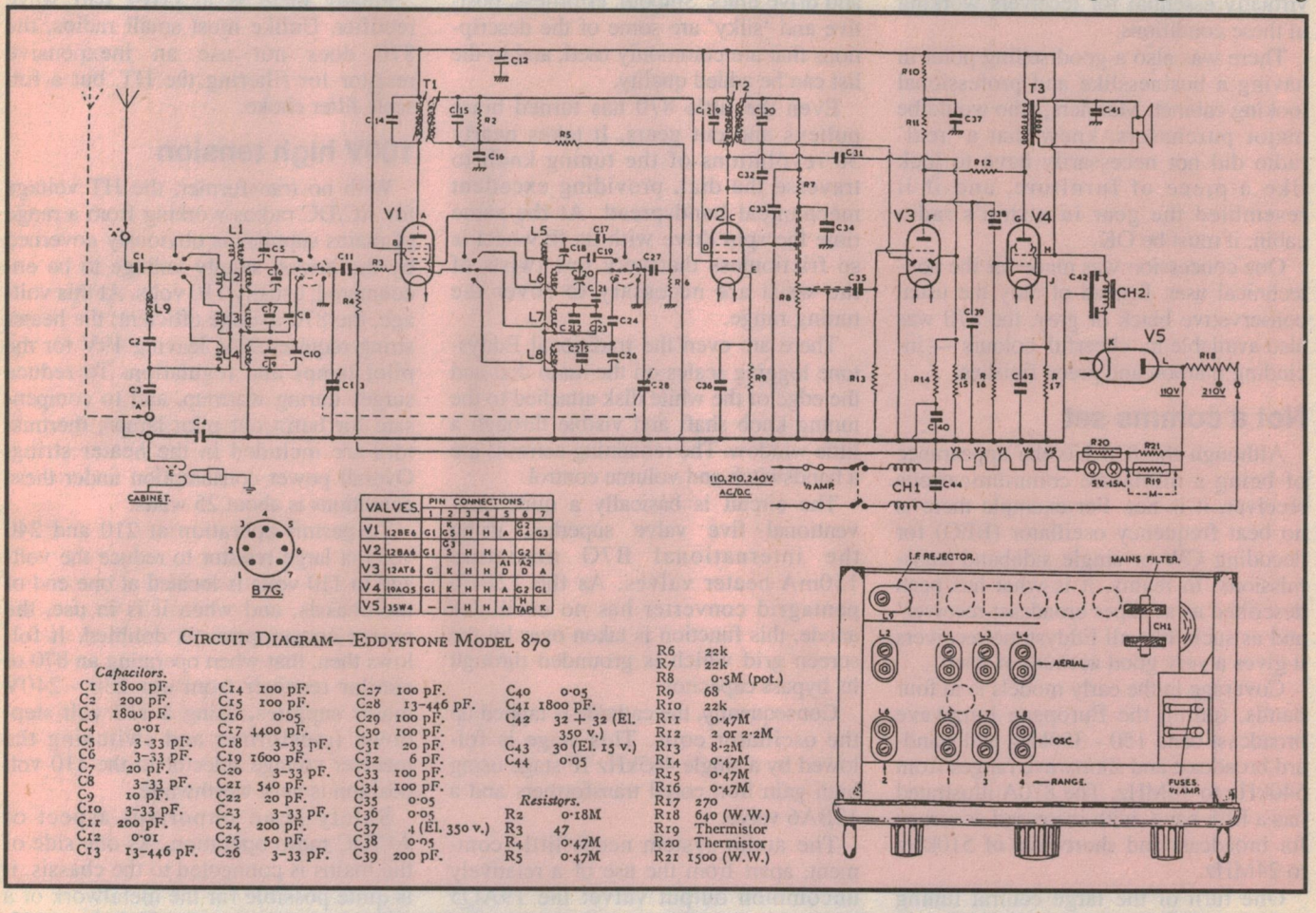
However, the circuit alone is deceptive and there is much more to the 870 than just another utility radio. Immediately obvious is the absence of the plastic cabinet and very basic dial usually found in economy radios. Instead there is the distinctive and nicely proportioned steel cabinet that was almost an Eddystone icon, right down to the chromed handles and full width multiband dial.

Cost saving was a major reason for building receivers without power transformers, as these were often the most expensive individual component in valve receivers. Even so, the English price of the 870 was about £30, more than double that of everyday budget priced radios.

In fact, there were quite a number of other AC/DC Eddystone models, and economy was really not a factor in making the 870 transformerless. Strattons were, as we have seen, very experienced at building marine radio equipment, and their description of the 870 as a 'Cabin Receiver' provides the clue as to its intended purpose. The Eddystone mini receiver was primarily intended as a shipboard receiver, where traditionally there were DC supplies — around 100 volts for smaller ships and 220V for large vessels. Obviously mains transformers are of little value in marine receivers.

Shipboard environments are very hostile to radio reception. With all manner of commutator motors and contacts going snap-crackle-pop and making frying sounds.

Mains-borne interference is quite serious, demanding stringent screening



VALVES	PIN CONNECTIONS						
	1	2	3	4	5	6	7
V1 12BE6	G1	K G5	H	H	A	G2 G4	G3
V2 12BA6	G1	G3 S	H	H	A	G2	K
V3 12AT6	G	K	H	H	A1 D	A2 D	A
V4 19AQ5	G1	K	H	H	A	G2	G1
V5 35W4	–	–	H	H	A	H TAP	K

CIRCUIT DIAGRAM—EDDYSTONE MODEL 870

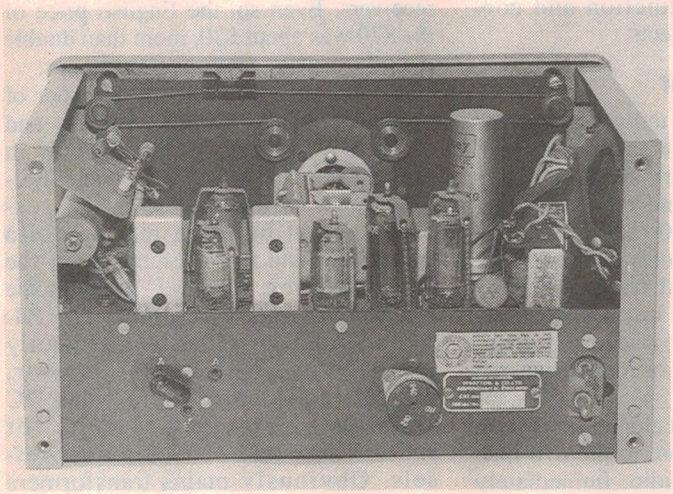
Capacitors.

C1	1800 pF.	C14	100 pF.	C27	100 pF.	C40	0·05
C2	200 pF.	C15	100 pF.	C28	13–446 pF.	C41	1800 pF.
C3	1800 pF.	C16	0·05	C29	100 pF.	C42	32 + 32 (El. 350 v.)
C4	0·01	C17	4400 pF.	C30	100 pF.	C43	30 (El. 15 v.)
C5	3–33 pF.	C18	3–33 pF.	C31	20 pF.	C44	0·05
C6	3–33 pF.	C19	1600 pF.	C32	6 pF.		
C7	20 pF.	C20	3–33 pF.	C33	100 pF.		
C8	3–33 pF.	C21	540 pF.	C34	100 pF.		
C9	10 pF.	C22	20 pF.	C35	0·05		
C10	3–33 pF.	C23	3–33 pF.	C36	0·05		
C11	200 pF.	C24	200 pF.	C37	4 (El. 350 v.)		
C12	0·01	C25	50 pF.	C38	0·05		
C13	13–446 pF.	C26	3–33 pF.	C39	200 pF.		

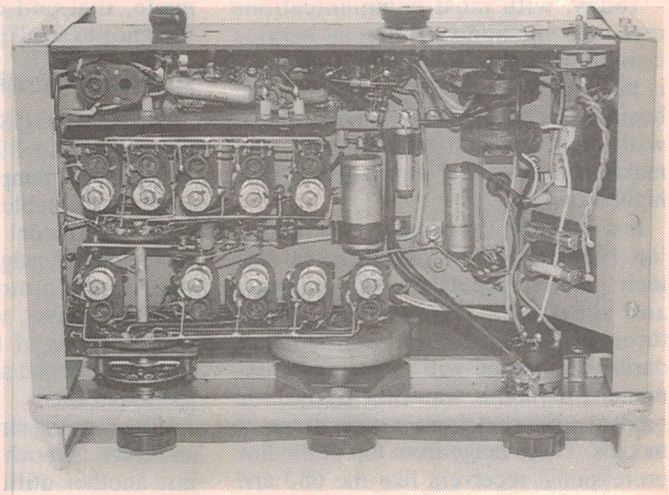
Resistors.

R2	0·18M	R6	22k
R3	47	R7	22k
R4	0·47M	R8	0·5M (pot.)
R5	0·47M	R9	68
		R10	22k
		R11	0·47M
		R12	2 or 2·2M
		R13	8·2M
		R14	0·47M
		R15	0·47M
		R16	0·47M
		R17	270
		R18	640 (W.W.)
		R19	Thermistor
		R20	Thermistor
		R21	1500 (W.W.)

Although there are a number of refinements, the basic circuit of the 870 is that of a simple five valve AC/DC receiver. It is most desirable to use a mains isolating transformer when working on this type of receiver.



The valve retaining springs indicate that this is a receiver capable of withstanding vibration and handling. Some of the high quality machined parts of the dial drives are visible in the centre.



Eddystone receivers always had neat and orderly wiring, and large components are clamped to the chassis. The large coils at the upper right are the line filters, essential for keeping out mains borne interference.

and filtering. Metal cabinets and thorough filtering of mains leads were virtually essential for receivers working in these conditions.

There was also a good selling point in having a businesslike and professional looking cabinet. Mariners, who would be major purchasers, knew that a 'real' radio did not necessarily have to look like a piece of furniture, and if it resembled the gear in a ship's radio cabin, it must be OK.

One concession was made for the non-technical user. Instead of only the usual conservative black or grey, the 870 was also available in 'cheerful' colours — including maroon and green finishes.

Not a comms set

Although the 870 has the appearance of being a miniature communications receiver, it is not. For example there is no beat frequency oscillator (BFO) for decoding CW or single sideband transmissions. In reality, it is what has been described as a 'super broadcast receiver' and as such, like all Eddystone receivers it gives a very good account of itself.

Coverage in the early models is in four bands, tuning the European longwave broadcast band 150 - 350kHz and standard broadcast and shortwave ranges from 540kHz to 18MHz. The 870A illustrated has a fifth band, with increased coverage for broadcast and shortwave of 510kHz to 24MHz.

One turn of the large central tuning knob is sufficient to demonstrate what an Eddystone receiver is all about. Being fine mechanical as well as electronics engineers, Strattons made superb dials and drive units. Smooth, effortless, positive and 'silky' are some of the descriptions that are commonly used, and to the list can be added quality.

Even the little 870 has turned brass pulleys and cut gears. It takes nearly 50 revolutions of the tuning knob to traverse the dial, providing excellent mechanical bandspread. At the same time the spin drive with its flywheel is so frictionless that very few twists of the wrist are necessary to cover the tuning range.

There are even the traditional Eddystone logging scales on the main dial and the edge of the white disk attached to the tuning knob shaft and visible through a little window. The remaining controls are a bandswitch and volume control.

The circuit is basically a quite conventional five valve superhet, using the international B7G miniature 150mA heater valves. As the 12BE6 pentagrid converter has no oscillator anode, this function is taken over by the screen grid which is grounded through its bypass capacitor.

Consequently, the cathode is tapped up the oscillator coils. This stage is followed by a single 465kHz IF stage using high gain iron cored transformers and a 12BA6 valve.

The audio system needs little comment, apart from the use of a relatively uncommon output valve: the 19AQ5 beam tetrode. This is equivalent to the more familiar 6AQ5 and 6V6, but of course has a 150mA heater to operate in series with the other valves.

Finally there is a 35W4 half wave rectifier. Unlike most small radios, the 870 does not use an inexpensive resistor for filtering the HT, but a full scale filter choke.

100V high tension

With no transformer, the HT voltage for AC/DC radios working from a range of mains supplies is obviously governed by the lowest supply voltage to be encountered, usually 110 volts. At this voltage, the 870 is quite efficient; the heater string requires 91V, leaving 19V for the pilot lamps and regulation. To reduce surges during warmup, and to compensate for burnt out pilot lamps, thermistors are included in the heater string. Overall power consumption under these conditions is about 25 watts.

To permit operation at 210 and 240 volts, a large resistor to reduce the voltage to 110 volts is located at one end of the chassis, and when it is in use, the power consumption is doubled. It follows then, that when operating an 870 or similar receiver from our 230 - 240V mains supplies, using a 110 volt step-down transformer and switching the receiver voltage selector to the 110 volt position is very worthwhile.

Safety is an important aspect of AC/DC radio operation. As one side of the mains is connected to the chassis, it is quite possible for the metalwork of a receiver to become 'live'.

This problem is compounded by the

metal case of the 870, and was solved by insulating the cabinet with nylon grommets around control shafts and cabinet mounting bolts.

It is especially important, therefore that capacitor C4 should have a high voltage rating and low leakage. Other components to check are the small black metallised foil bypass and audio coupling capacitors, and R11, the 12AT6 anode resistor. But otherwise, the conservative design and relative simplicity ensures that it's unlikely much will be found wrong.

Although the 870's absolute sensitivity, image rejection and selectivity can in no way be comparable with a full scale communications receiver, its performance is much superior to equivalent domestic receivers and can be used for quite serious DX work. Indeed it can outperform many much more complex sets.

Do not pass up a chance to obtain one of these cute little receivers, as they make great bedside or desktop radios, are a pleasure to use, and are small enough to take along on holiday, (not forgetting a few metres of insulated aerial wire) for better than normal radio reception.

Before closing, some further information has emerged regarding the Wunderlich valve, which was the subject of last October's column.

More on the Wunderlich

Most data available indicates that the planned Wunderlich B valve was to have had the addition of a screen grid. This is confirmed by valve tables appearing in normally authoritative publications from Henny, Ghirardi, Babani and National Union.

However, from John Stokes has come a copy of an article that Norman Wunderlich himself published in the March 1933 *Radio Engineering*, about the planned B valve — and showing quite clearly that the added electrode was to be a diode intended for various AGC applications.

The Wunderlich B would therefore have been a double triode/diode, but as events turned out, was forestalled by the double diode/triodes that remained standard to the end of the valve era. It is unlikely that the Wunderlich B was ever made commercially.

We mentioned also the Sylvania double triode alternatives, and the use of their type 70 in a Sparton car radio. Another receiver, the Midwest 1933 16 valve model has emerged as also using a dual grid detector, in this instance the type 29 Sylvania double triode. ❖

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READER INFO NO. 22

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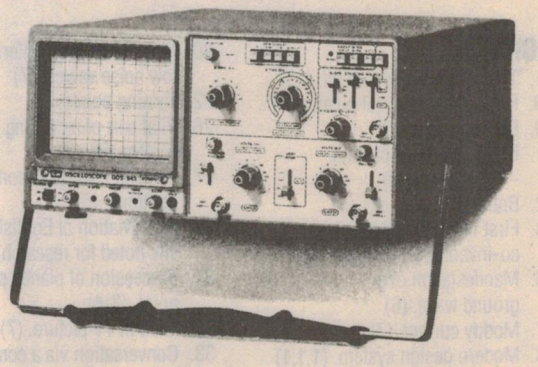

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READER INFO NO. 21

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

April 1945

New Eastman Kodak paint: A new layout paint has been developed by Eastman Kodak for accurate, rapid and easy marking of metal parts.

Drawings of lines to be machined are laid on the metal, which has been prepared with the paint and briefly exposed to light. The transfer of the drawing to the metal is accomplished in much the same manner as with blue print photographic film development.

The lines which remain after the metal is washed are what is left of the layout paint after development, and they are said to withstand all mechanical operations with loosening, even resisting the application of a cutting torch except, of course, when the metal carries the paint away with it.

April 1970

Sydney's radiotelescope: A team of electrical engineers from Sydney University, under the leadership of radio-astronomer Professor W.N. Christiansen, is renovating a 15 year old antenna array at Fleurs, 30 miles west of Sydney. The cross shaped telescope consists of 64 19ft diameter dishes in two rows, forming a compound interferometer, originally used by the CSIRO to make the first daily maps of the sun.

Four 45ft diameter dishes have been added to the ends of the arms, and racks of complex electronic equipment have been installed. The circuitry combines the 68 antennae into the equivalent of one giant dish. One arm of the interferometer is equivalent to a dish one mile in diameter.

The Fleurs radio telescope will be used for mapping a small area of the sky with a resolution of 40 seconds of arc.

Darwin television: A contract, valued at nearly $350,000 has been awarded to Harris James Pty Ltd for construction of television studios at Darwin for the Australian Broadcasting Commission.

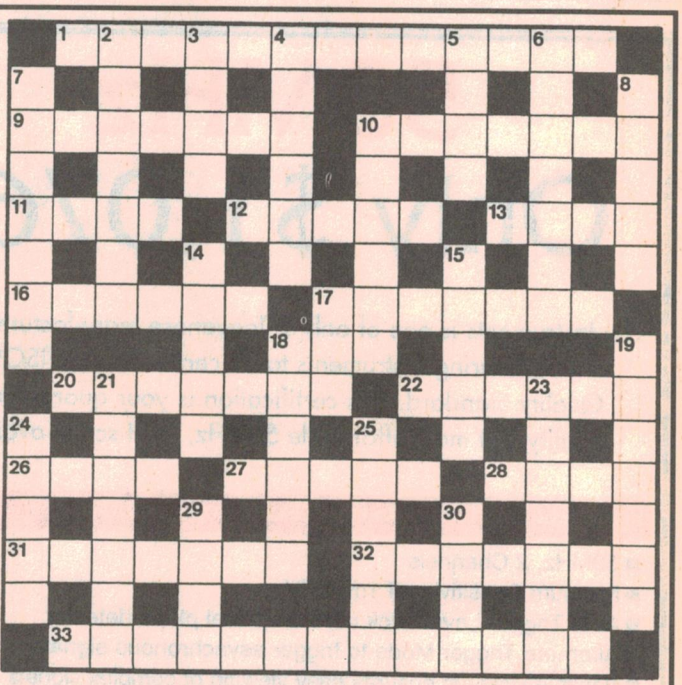
The contract is due for completion by February 1971, and television broadcasting is expected to begin in June 1971. The new building will be on a site adjoining the existing ABC radio studios and connected by a covered way.

Quantam expansion: Qantas Airways Ltd has ordered equipment to the value of $17.7 million to expand its computer complex, Quantam.

Advanced equipment worth $13.5 million will be purchased from IBM, Honeywell and Raytheon. In addition, $4.2 million will be spent on essential support equipment services and the fitting of reservations and booking offices throughout the world to accommodate the new equipment.

The expansion is geared to the introduction of four Boeing 747B aircraft in 1971 and the anticipated increased in passenger bookings. It is also based on estimates that the airline will be more than three times its present size by 1980. ❖

EA CROSSWORD



ACROSS

1. Type of mobile phone kit. (13)
9. Rhythmical musical quality. (7)
10. Bevelled edge. (7)
11. Bionic implants can aid —— people. (4)
12. Brand of copier, etc. (5)
13. First name of Bardeen, co-inventor of transistor. (4)
16. Manifestation of a ground wave. (6)
17. Modify current. (7)
18. Modern design system. (1,1,1)
20. Metal used as a getter in low noise valves. (7)
22. Turning points. (6)
26. Vital part of recording system. (4)
27. Element used to absorb neutrons. (5)
28. Abbreviation of English university noted for research. (4)
31. Procession of planes past a point. (3-4)
32. Fault in TV picture. (7)
33. Conversation via a com munication system. (9,4)

SOLUTION FOR MARCH 1995

S	H	O	E	M	A	K	E	R		K	O	D	A	K
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L		E		S		I		E		O		D		H
E	A	R	T	H		C	O	T	A	N	G	E	N	T

DOWN

2. Transmits (7)
3. Usual voltage of battery in a smoke detector. (4)
4. Shaped parts of electric motor, the pole ——. (6)
5. Brand of hi-fi equipment. (4)
6. Critical moment in satellite delivery. (7)
7. What can be expressed by pH? (7)
8. Instruction for word processor. (5)
10. Status for a switch. (6)
14. German derived brand name of electrical equipment. (5)
15. Produce chords by sweeping. (5)
17. Type of memory. (3)
18. Limiting device. (3-3)
19. Charles ——, computer pioneer of the 19th century. (7)
21. Separate into component parts. (7)
23. Type of cable. (7)
24. Change of wavelength of spectral line. (5)
25. Insulation material. (6)
29. Electrode. (4)
30. Standard mineral used in testing hardness. (4)

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S·U·P·P·L·E·M·E·N·T

AGREEMENT REACHED ON 'SUPER DENSITY' VIDEO CD

TELECOM AWARDS $50M CONTRACT FOR JINDALEE 'OVER HORIZON' RADAR

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NEWS HIGHLIGHTS

'SUPER DENSITY' VIDEO CD AGREEMENT

Hitachi, Matsushita Electric Industrial Co., MCA, Pioneer Electronic Corporation, Thomson Consumer Electronics, Time Warner and Toshiba Corporation have reached agreement on and proposed the 'SD' (Super Density Disc) format for the next generation of digital video discs (DVD). This innovative new standard introduces an advanced play only optical disc that stores high quality digital moving images and sound on a 120mm disc, the same size as conventional audio CDs.

The companies supporting SD are to propose the format to the motion picture industry and hardware manufacturers. The format has already received endorsements from Mitsubishi Electric Corporation, Victor Company of Japan, Ltd., Nippon Columbia Co., Toshiba-EMI Ltd., and Pioneer LDC, Inc.

The features of the SD format include:

1. Discs developed to the SD format are formed by back-to-back bonding of two 0.6mm discs. They offer highly accurate readability, and can hold up to five gigabytes of high density data on just a single side — more than 7.5 times the 650-megabyte capacity of a standard CD. The total double-sided capacity is 10 gigabytes.
2. The combination of digital image compression technology to the MPEG-2 standard and encoding at a high speed variable transfer rate (average 4.69 megabits per second) allows each side of the new disc to carry up to 142 minutes of high quality images and sound, enough for most full length feature movies.
3. The format supports Dolby AC-3 (5.1ch), allowing home systems to offer the same dynamic sound as state of the art cinemas.
4. The SD format discs offer a maximum of eight audio channels, allowing film soundtracks to be stored in multiple languages, and 32 subtitle channels. Different language and subtitle combinations can be selected by users.
5. The format can be used in computer related applications as a very large capacity ROM offering much higher quality video input than current systems, and can also be used as very long play, high fidelity audio discs.
6. The format offers compatibility with current optical discs, including music CDs and laser discs. SD players can be easily designed to maintain backward compatibility with current CDs and LDs.

The specifications of the SD format have been realised by using a new pick up technology, employing a short wavelength red (635nm) laser; a track pitch of 0.725um; high efficiency modulation; and enhanced error correction coding.

Claimed to be the world's smallest wireless modem card, Motorola's PM 100D plugs into the PCMCIA slot of portable computers and PDAs. It's available from Sourceware; phone (02) 427 7999.

TELECOM AWARDS $50M JORN CONTRACT

Telecom Applied Technologies has selected John Holland Construction and Engineering as the construction contractor for facilities at remote sites of the Jindalee Operational Radar Network (JORN). The contract, valued at more than $50 million, is for the construction of radar equipment buildings, power stations, staff accommodation and amenities near Longreach, in Queensland and Laverton in Western Australia.

Work is expected to be finished by December, 1995, about three months ahead of initial project schedules.

Telecom's Jindalee Project Director, Mr Ron Dicker, said that the tender process focussed on the ability of companies to manage construction under difficult conditions at remote radar sites in outback Australia.

"Construction schedules are tight and it is important that the buildings be available on time," he said. "John Holland offered a very competitive price and their proposal reflected a good understanding of the JORN project."

Brisbane company Lindsay Ekert and Associates, which worked with Telecom on the design of the JORN facilities, will continue involvement and provide site supervision and quality assurance services on behalf of Telecom.

"Close monitoring during the construction phase will be required to ensure achievement of design requirements and radar performance," said Mr Dicker.

"More than 300 people will be employed on construction at the radar sites and John Holland propose to use resources from local communities and industry where possible."

NEW SAFETY CAMERAS COME ON LINE IN NSW

Special new cameras which detect speeding by heavy vehicles have begun operation at sites around NSW, Transport Minister Bruce Baird has announced. Mr Baird said the cameras were part of SAFE-T-CAM, a new $13 million system which captures the images of heavy vehicles, reads the number plates and records the time and date the vehicles passed the camera site. He said the new system could measure a vehicle's travel time between two or more points.

"The image and data recorded at the various locations is fed through to a central computer at Flemington, which is now on line," he said. "The technology determines where the truck or bus was last seen on the network and whether the time difference between the two loca-

tions indicates that the vehicle has been speeding."

Mr Baird said the first four sites in NSW will operate at:

- Bargo on the Hume Highway, south of Campbelltown.
- Gundagai on the Hume Highway.
- Wyong on the F3 Freeway on the Central Coast.
- Deepwater on the New England Highway near Tenterfield.

"By the end of the year a total of 20 sites will be up and running," he said.

SAFE-T-CAM technology is claimed as a world first, and was developed by a consortium comprising the Roads and Traffic Authority, Telecom, CSIRO and Telstar.

INMARSAT-P ATTRACTS US$1B INVESTMENT

Inmarsat has received formal indications of intent to invest in its affiliate company, being formed to implement a global handheld satellite phone service, exceeding US$1 billion. Authorised initial investors from more than 40 countries, covering six continents have filed 'intent to invest' forms with Inmarsat. The investors are Inmarsat signatories or their subsidiaries, and comprise many of the world's leading telecommunications operators, a number of which are key players in the provision of mobile services. As a consequence of Inmarsat's 15% investment in the affiliate company, all of Inmarsat's 76 member signatories will also be indirect investors.

The new company's intermediate circular orbit satellite system will cost approximately US$2.6 billion and will provide world wide service to handheld terminals for digital telephone, fax, data and paging. It is expected to begin service in 1999 and be fully operational by 2000. A typical Inmarsat-P user in the year 2000 will carry a pocket telephone virtually indistinguishable from a current cellular phone. "We have received strong support from a broad range of investors, including those operating in emerging markets," said Olof Lundberg, director-general of Inmarsat. "The breadth and depth of investment will ensure the success of this international venture in establishing a new era of global mobile communications for everyone."

S-A WINS BROADBAND RIGHTS FOR OLYMPICS

The International Olympics Committee (IOC) claims that the 1996 Atlanta Summer Olympic Games will be the widest viewed television event ever. The Games will attract 70% of the world's television viewing population, with an audience of 3.5 billion viewers world wide.

Sole rights for the broadband distribution of all televising of the 1996 Games has been awarded to Scientific-Atlanta. Under the terms of the agreement, Scientific-Atlanta will create a digital video distribution system that will provide over 60 channels of video images to more than 15,000 TV monitors, at more than 40 Olympic locations.

This high speed, digital network will provide live broadcast quality video from the venues within metropolitan Atlanta to print and broadcast journalists,

NETCOMM LAUNCHES INTERNET SOLUTION

Australian modem manufacturer NetComm has launched Enternet, a total solution for Windows based PC users wanting to venture onto the Internet with maximised setup and connection ease. Based on the seamless integration of a formidable array of standards compliant software, the Enternet package provides users with hardware, software, Internet access, on-line support, training and detailed information. The package is available with or without a NetComm modem.

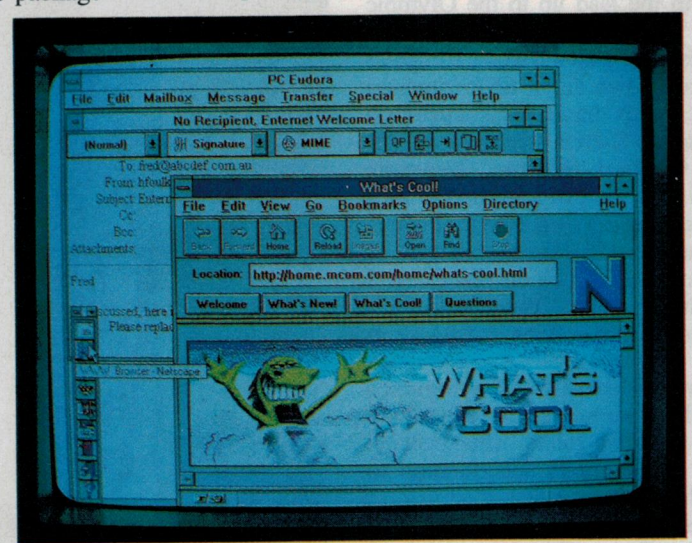
"This is the first complete Internet package for the first time Australian user," said Chris Howells, NetComm managing director. "With Enternet there's no pain on the initial breakthrough into cyberspace."

"The solution is designed to demystify the often difficult process of getting started by bringing together all the elements needed for the new user. From installation, the Enternet solution guides the user through a series of dialog boxes."

Enternet is designed for use with any NetComm modem and is bundled with either a NetComm AutoModem E7F modem operating at 14.4kbps, or an AutoModem E34F operating at 28.8kbps.

The Enternet software is made up of:

- Fast and reliable connectivity software.
- An easy to operate user interface that leads the new user through the process of installation, registration and on-line credit check.
- A unique applications manager bar that allows users to swap between applications, help and setup by clicking on icons.
- An Open Systems Internet environment that allows users to chose what software they need and easily add applications. The NetComm Home page will assist users to continually upgrade.
- Applications including E-mail; Web Browser; Newsgroup; Telnet; FTP; IRC; Gopher.
- On-line help.



The Enternet product solution also provides comprehensive manuals; a background book on the Internet — what it is and how to use it; a hotline help service; and regular Internet startup training clinics throughout Australia.

The NetComm Enternet product solution is the result of an alliance of Australian developers which are recognised leaders in their fields.

The Cooee Enternet software was written by Doug Scadlock of Cybersoft, the authors of Cooee data, fax and voice. The connectivity software was designed and written by Peter Tattam of Trumpet Software International, famous world wide for Slip/PPP connectivity software. Access to the Internet has been arranged through service provider Connect.com.au, one of the few Australian service providers who provide connection at 28.8kb/s.

athletes, coaches and Olympic family members and spectators at the Summer Olympic Games.

The Scientific-Atlanta broadcast distribution system will allow the video images produced by television crews at each of over 40 televised Olympic locations to be distributed within each venue and within the International Broadcast Centre (IBC).

The IBC will be the central location which will support the transmission of video and audio signals to viewers around the world. In addition, Scientific-Atlanta will provide a network that will include more than 6600 digital video set-top terminals to allow viewers at all metropolitan Atlanta Olympic sites to receive simultaneous coverage of all televised Olympic activity.

The Olympic sites include the Olympic Press Centres, the International Olympic Committee's hotel, the ACOG Operations Centre, the Olympic Village and the competitive venues themselves.

Billy Paynes, President and Chief Executive Officer of the Atlantic Committee for the Olympic Games said, "The technology Scientific-Atlanta will provide will enable us, for the first time, to feed very high quality video to spectator displays and stand alone monitors so that not only athletes and journalists but also Olympic ticket holders will see coverage of events and activities in other venues during breaks in the action."

MOBILE COMMS SHOW FOR MELBOURNE

MobileCom, Australia's only specialist event for the mobile communications industry, will be held for the first time in Melbourne from 30 March until 1 April at the Royal Exhibition Building.

The first MobileCom show, held in Sydney during November last year, was welcomed by the industry, business users and the general public. Keen to buy at the best possible prices and find out about the latest products, people visited the show in thousands. The mobile communications industry also welcome the opportunity to exhibit in a forum dedicated specifically to their industry, and all the major carriers, manufacturers and dealers participated.

Show organisers Malcolm Hamilton and Tony Pool are expecting between 12,000 and 15,000 people to attend MobileCom in Melbourne.

"The first MobileCom event proved particularly popular with business users, who visited the show in higher than predicted numbers — showing that while the domestic market has been stimulated by lower prices and mobile products aimed at their market, business users continue to account for the majority of mobile voice and data usage. For this reason, the show has been extended over an extra weekday to cater for business people."

"Of particular interest to business people at MobileCom will be the predominant theme of mobile data. The convergence of cellular phones and computers has made telecommuting a reality for leading companies such as IBM, and MobileCom promises to preview some exciting new releases in this area," said Mr Hamilton.

The Melbourne MobileCom event will feature the major carriers and mobile communications suppliers including Optus, Telecom and Vodafone, Strathfield, Let's Talk Communications,

20KW OF SOUND ON TWO TOWERS

Spectators at Sydney's Athletic Sports Centre will hear the commentator's words as 'clear as crystal', thanks to a massive public address system installed by AR Audio Engineering of Sydney. Up to 20,000 watts of power can provide articulate commentary and CD quality audio to every seat at the Homebush sports centre, in the lead up to the Olympic 2000 games.

The system was designed using the Acoustacad computer software and the audio system known as an SST (Stadium Sound Technology) system which basically focuses on delivering the sound from a single source — similar to AR Audio's other installations at Concord, Belmore, Brookvale and Leichhardt Ovals. In this case the program had to provide for two main point sources, using two 100 foot masts at opposing ends of the stadium. This is in contrast to more conventional sound installations, which place many small speakers throughout the complex. The notable advantage of the AR SST system is that echoes and standing waves are eliminated.

The installation of this system constituted a logistics nightmare, in that the horns alone were over eight feet long and the amps weighed close to half a tonne. The speakers also had to meet an outside environment specification to handle Sydney's climatic conditions.

In commenting on AR Audio Engineering's successful winning of the contract Mr Tony Russo (Director) stated, "I am delighted that our company is playing such an integral part in the lead up to the Sydney 2000 Olympics. Our experience in installing PA systems to demanding and complex projects such as Concord Oval, the Family Law Courts, Park Hyatt Sydney and the QVB has given us the technology to complete major audio systems to world standards. I believe that the creative skills in audio system design available in Australia will ensure that whatever should be heard, will be heard during the 2000 Olympics."

Bosch, Banksia, Tech Rentals and Autophone.

US LENS COMPANY TO SET UP IN ADELAIDE

US based Transitions Optical is to set up a lens manufacturing plant in Adelaide. The company is the world's market leader in plastic photochromic lens technology, whose products have evolved out of a revolutionary process for building photochromic properties into plastic lenses where the variable tint adjusts to incoming light, as well as blocking 99% of UV-A and 100% of UV-B rays.

Transitions Optical employs 450 staff in the US, has a sales office in Paris and opened a manufacturing plant in Ireland in April 1994 to service the European market. An office was also opened in Singapore last year.

Federal Minister for Small Business, Senator Chris Schacht said the Adelaide plant, expected to be commissioned later this year, would generate up to 40 jobs.

"Australia is a strategic gateway to Asia because of the sophisticated local-market and familiarity with American business practices," he said. "Transitions' decision to locate the plant here is evidence Australia is increasingly being seen as a regional centre for high technology development."

DEAL TO MAKE PAY TV CABLE IN VICTORIA

Under a new arrangement forged between Telstra, Philips Electronics and Olex Cables, coaxial cable for Telstra's pay TV network will be manufactured in Australia.

Philips Electronics, the prime vendor and systems integrator for the Telstra pay TV network, has appointed Olex Cables (a division of Pacific Dunlop) as its supplier of coaxial cable which, until now, has come from Times Fibre in the USA. Olex is now establishing a joint venture company with Times Fibre to produce this cable, in a new factory at Olex's Tottenham site in Victoria.

With an estimated $8M to $10M capital investment, the Olex plant will become the only location in the world, outside North America and a new facility coming on-line in China, to produce hard line aluminium CATV cable.

The contract with Philips will be worth around $50M for Olex. A Philips spokesman said that this new supply arrangement is highly significant for the Australian cable industry, and represents the first signed up agreement for large scale Australian manufacture of equipment for Telstra's broadband information superhighway.

Philips already has contracts with HPM for local manufacture of wall plates and is currently preparing business plans for local manufacture of other key items, including the underground amplifiers which are distributed along the cable.

NEWS BRIEFS

- A conference called ***Developing Australia's Telecommunications Infrastructure*** will be held at the Intercontinental Hotel in Sydney, April 6-7, 1995. For more information, phone (02) 954 5844.
- ***National Semiconductor*** has announced the appointment of two senior marketing executives: Edwin Long, in charge of the Digital division and Tony Mui, in charge of the Discrete Power and Signal Technologies division. Both senior executives will be based in Hong Kong with responsibilities for the Southeast Asia region.
- The Network Systems group of ***Siemens AG*** has set up a total of nine business offices in the Asia/Pacific region. The headquarters office for Australia and New Zealand is in Melbourne. For more information phone (03) 420 7200.
- ***ATUG '95***, the 12th Australian Telecommunications and Data Networking exhibition and conference, will be held at the Sydney Convention and Exhibition Centre, May 2-4, 1995.
- ***Thomas Electronics*** has been appointed as the official Australian repair facility for Eizo Corporation's range of display monitors.
- ***Fairlight ESP*** has appointed Mr John Lancken as International Marketing Manager, Mr Nick Cook as Director European Operations and Mr Wayne Freeman as CEO of the newly formed Fairlight USA. ❖

WINNERS OF HP MULTIMETERS

During October, November and December 1994, new and renewing subscribers to *Electronics Australia* were eligible to win one of 15 Hewlett-Packard HP 973A handheld digital multimeters. The HP 973A multimeter provides 3-1/2 digit plus analog display, 0.1% accuracy, true RMS measurements, 20kHz frequency response, Min/Max/Average calculation and AC/DC current measurements to 10A. Each meter is valued at $527, giving a total prize value of $7905.

And the lucky *EA* subscribers who were winners of one of these multimeters were:

M.A. Birmingham, of Baulkham Hills NSW
Mr K.N. Schokker, of Burns Beach WA
Mr Burrows, of Sadliers Crossing Qld
Mr O. Allison, of Boort Vic
Mr A. Perkins, of Devonport Tas
Mr J. Markotich, of Gordonvale Qld
Mr J.L. Tottenham, of Yass NSW
Mr C.J. Gamgee, of Carnegie Vic
Mr J. Loadsman, of Stanmore NSW
Mr C.J. Krutbosch, of Albury NSW
G. Rossiter, of Kippa Ring Qld
Mr P. Kutas, of Shortland NSW
R.E. Foreman, of Glenalta SA
Mr Day, of Victor Harbour SA
C.C. Ballarat, of Ballarat Vic

Our congratulations to these winners, and we trust that they are finding their new HP 973A multimeters very useful. Our thanks to Hewlett-Packard Australia for sponsoring this promotion, and to all of the readers who subscribed in the period concerned.

TELLABS CROSS-CONNECTS FOR VODAFONE

Ericsson Australia is to supply Tellabs Martis DXX cross-connect equipment to Vodafone Australia. This is the first major win following the establishment of an OEM and collaboration agreement in October 1994, whereby the Tellabs Martis DXX system is marketed world wide by Ericsson Radio Access AB as an integral part of its cellular transport network solution.

The terms of the Vodafone contract, which covers the turnkey provision of major and minor Martis DXX nodes to enhance the network that is rapidly spreading from capital cities to provincial centres, were not disclosed.

"Our long standing, successful relationship with Ericsson takes on additional significance as we join together to meet our customers' needs," said Peter A. Guglielmi, president of Tellabs International, Inc. "This partnership leverages the strengths of both companies. Ericsson's continued success in the cellular market place will help us to accelerate the global deployment of the Tellabs Martis solution."

Vodafone, which has a licence to build an all new, GSM mobile digital network in Australia, launched its service in October 1993. The Vodafone mobile digital network now extends to all Australian capital cities. A regional roll out is well underway with 80% of Australia's population to be covered by the end of 1995.

"We selected the Martis DXX because of its advanced network management system and expansion capabilities," said Vodafone's managing director John Rohan. "The DXX will provide greater flexibility in the connection of all parts of our extensive mobile digital network in Australia." ❖

Making PCBs directly from the artwork...

THE SUPERFUSER

We try out a simple but effective device that transfers a photocopy or laser printer image directly from the paper, to either a sheet of PCB laminate or aluminium.

by PETER PHILLIPS

Readers of Information Centre will be aware of the many techniques that have been described in that column to produce a PCB. Central to all these methods is a means of transferring toner from a photocopy or laser printout of the PCB pattern, directly to the surface of the PCB laminate.

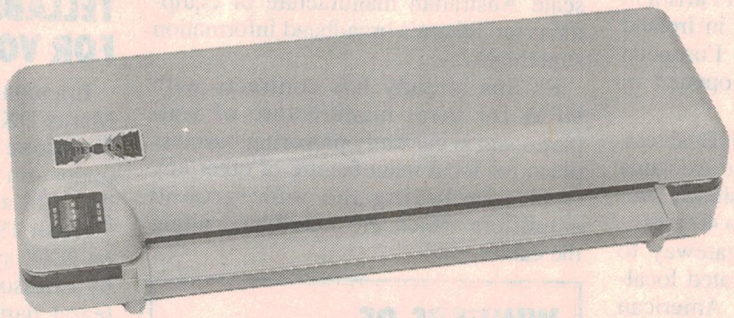
Some of the techniques involve ironing the image from the paper onto the laminate with a steam-and-dry iron, or placing a heated iron plate on the paper, as it lies face down on the laminate. Either way, the idea is to transfer the toner with a combination of pressure and heat.

The catalyst for all these ideas was a review by Peter Murtagh in the August '93 issue of a technique called the Toner Transfer System, or TTS. In this system, the photocopy or laser printer printout is done on specially treated paper (called TTS paper) which, because of its special coating, allows a total transfer of the toner. The product we're reviewing here is called the Superfuser, which is a device that supplies the heat and pressure so essential to the TTS system.

The Superfuser

The Superfuser is the essence of simplicity. It's relatively compact at 430 x 140 x 115mm (W x D x H), with the works housed in a grey plastic case. Inside the case are two pairs of rubberised rollers and two temperature controlled heating elements, arranged as shown in Fig.1. The inside of the Superfuser is shown in the photo of Fig.2. The rollers become quite hot due to their proximity to the heating elements, and their relatively close spacing gives the pressure.

In operation, the image to be transferred is first either photocopied or printed via a laser printer onto a sheet of TTS paper. The printout needs to be mirror-reversed to get the correct final result. After cleaning the PCB, the paper is laid image side against the laminate, and the combination is fed into the Superfuser. The transfer speed is almost imperceptibly slow, at 25.4mm per minute. It takes an object four minutes to pass from one set of rollers to the next, so for a decent size PCB, you must allow about 10 minutes. Once the fusing is complete, the paper is removed by soaking the paper off the board, by submersing the laminate-paper in water. If all is well, the TTS paper will lift cleanly off the laminate, leaving the toner pattern bonded to the copper surface.



The TTS system has other uses, including transferring an image to aluminium, or even making decals. Palmtech, importers of the US made Superfuser, supplied us with an example PCB and aluminium panel, the quality and detail of which suggested we could expect excellent results. To help us in the review, Palmtech also supplied us with a pack of TTS paper. Here's what we found...

PCB making

Because the TTS paper is fairly expensive, we decided first to see what sort of results could be obtained by using conventional paper.

The paper we used has a glaze, so it's probably slightly better than normal photocopy paper. We chose a complex PCB pattern as the test, and used a 600dpi HP Laserjet 4 laser printer, which gives a very dark and crisp printout.

The literature supplied with the Superfuser urged a few test runs to determine the best heat setting, but we decided to see what would happen anyway. A piece of single-sided PCB laminate was cleaned with steelwool and soap, and following the manufacturer's recommendation, it was also given a quick rub with some 600-grit abrasive paper.

After passing through the Superfuser, the laminate and its now bonded paper were soaked in water, and after a few minutes, the paper was gently removed. However, unlike the TTS paper, conventional paper doesn't just lift off. Instead it leaves a thin layer that is bonded to the toner...

While it's easy to remove all traces of the paper not in contact with the toner, you can see a grey look to the normally pitch black toner, proving that a very thin layer of paper is now permanently dissolved in the toner. However, this has no effect on the resist qualities of the pattern.

We were surprised at the robustness of the transferred toner. The PCB surface could be rubbed with a scrubbing brush without damaging the track pattern. And there were no problems at all with the transfer, apart for a small section in one corner, perhaps because the heat setting was not optimised for the toner we were using.

The PCB that resulted is shown in Fig.3, unfortunately with insufficient contrast to show all the detail. The board has been drilled, ready for use. There are no breaks, shorts or other problems, and the final result is as good it would have been with conventional photographic techniques.

Aluminium panel

Our tests with aluminium were not quite so successful. We decided to make a front panel using the same technique as for the PCB, so a piece of aluminium was cleaned with steel wool and soap, making sure it was free of any dirt and oil. The pattern was printed (in mirror reverse, via Corel Draw) on the same type of paper as